THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## PETROL 'BUSES v. ELECTRIC TRAMWAYS.

THE last few weeks have witnessed the launch of several new petrol omnibus companies, and it is a somewhat significant fact that in many cases the directors of the new companies are already directors of one or more electric tramway companies. This may be taken to indicate one of two things. Either the electric tramway directors are becoming alarmed and wish to ally themselves with the petrol industry before it is too late, or possibly those interested in electric tramways wish to become acquainted with the real facts as regards cost of operation and earning capacity of petrol motor-'buses. We believe the latter explanation is the more correct of the two.

As is often the case when electrical subjects are under discussion, the daily Press has taken up the motor-'bus question, and in many cases has made a hopeless hash of it, with the result that the mind of the public is being rapidly led to believe that motor-omnibuses will sweep electric tramways off the face of the earth; we shall therefore attempt to put before our readers what, at the present moment, we consider to be the true position.

We fear that company promoters are utilising the Press to push motor-omnibus companies, and to make their profit out of these, just as was done many years ago with the electric lighting undertakings. Certainly the arguments which are put forward in favour of the motor-'bus, as compared to tramways, show that the facts have not been carefully considered. Motor-omnibuses will have to run for a very much longer time than has as yet been possible, before accurate and reliable figures of cost of operating and maintenance, and the life of the various parts of the motor-omnibus, can be secured, but we think that the following figures will not be found very much out:—

COST PER 'BUS-MILE.

| | |
|---|---|
| Tires | 3d. |
| Repairs and maintenance of car and motor | 2d. |
| Oil, waste, grease and petrol | 1d. |
| Wages of drivers and conductors | 1·65d. |
| Renewal fund for rolling stock | 1·86d. |
| Garages, repairs, &c. | 1·86d. |
| Traffic expenses, rents and taxes | 1·60d. |
| Total | 11·11d. |
| Interest on capital | ·60d. |
| Total | 11·71d. |

The reports of the different tramway companies and the results obtained by municipal electric tramways in this country will show that there are very few electric tramways which are at the present moment making anything like the amount per car-mile which, we estimate, it would cost to operate a petrol 'bus. It is true that in some instances a few 'buses on the most lucrative London roads have shown very large earnings per mile, but this is partly owing to the novelty, because they are always travelling with their full

complement of passengers. Such results cannot be generally applied to a petrol 'bus system, which, in order to serve the public requirements, would naturally have to operate under very much the same conditions as our electric tramways are working under.

In looking through the total operating costs per car-mile of electric tramways in the United Kingdom, it will be seen that the average inclusive cost per car-mile in most cases does not exceed 8d. Taking this figure as a fair average, the difference between the total costs of a tramcar and of a petrol 'bus would be in round figures 4d. per car-mile. A petrol 'bus cannot be counted upon to run more than 24,000 miles a year, as experience has shown that electric tramcars, the repairs of which require certainly less time than those of petrol omnibuses, do not run more than 25,000 miles a year on an average.

On this basis, the extra cost of running a petrol 'bus as compared to an electric tramcar amounts to 5 per cent. on a capital of £8,000. Then allowing that on an average there are three electric tramcars to every mile of single track and that not more than the same number of omnibuses would be required—which, of course, understates the case, as the carrying capacity of a petrol omnibus is not much more than half the capacity of an electric tramcar—this would represent an extra capitalisation of £24,000 per mile of single track.

This amount is, however, not the whole, as the petrol 'buses, including the necessary repair shops and stabling, cost, on an average, at least £1,000 per 'bus.

The price of a really good 'bus will probably not be much under £950. Well-equipped workshops must be at hand, and store-rooms for petrol and oil. Car-sheds supplied with pits are also necessary, and the cost per car for this portion of the equipment will probably not be less than £200. It will therefore be seen that the estimated costs which we have given for petrol 'buses are, if anything, under the mark.

The reason for the heavier cost of operating is not far to seek. Everyone knows that the tractive resistance of a cart operating on the road is much greater than that of a vehicle on rails, and we do not think it necessary to bring forward arguments to demonstrate that rubber tires wear out much more quickly and are much more costly than steel tires. Also it seems hardly necessary to suggest that high-speed reciprocating gas engines, composed of a very large number of more or less fragile and complicated parts, must be much more expensive than the very simple electric tramway motors used to-day.

As regards the speed of electric tramcars being less than that of motor-omnibuses, we think that, were a large number of petrol 'buses introduced, they would certainly not be able to keep up a speed any higher than that which, from experience, we know is the average running speed of the County Council tramways, and which we are certain could not average much less than 10 miles an hour on the whole run from the bridges to the termini.

But to return to the question whether or not motor-omnibuses will supersede electric tramcars, we think that where, as in London, horse 'buses can live, notwithstanding electric tramways competition, it is certain that they can be advantageously replaced by motor-'buses. But where, as in practically all the other towns of this country, the electric tramways have run the horse 'buses off the road, we do not think that motor-omnibuses can permanently damage electric tramways.

Where petrol omnibuses are used in connection with electric tramways to connect up their termini with more distant villages, the traffic of which would not justify the extension of the tramways, the case is altered. Any such undertaking stands an excellent chance of being successful, and the satisfactory results which have been obtained from the Great Western Railway Co.'s experiment in this direction should encourage other railways and tramways to follow its good example.

**The New Patents Act.**

At the beginning of this year a momentous change was made in the procedure for granting patents for inventions. The old *laissez faire* policy of granting a patent for any alleged invention, whether it was new or not, was abandoned, and every application for a patent is now submitted to an examination for novelty. The search is not complete, it is true, being confined to inventions patented in this country within the last 50 years, but it is highly probable that there are very few valuable industrial inventions which are not to be found described in our patent literature covering the prescribed period.

The great defect of this Patents Act of 1902 is, in our opinion, that it gives inadequate protection to the public by refusing to give power to the authorities to suppress applications for patents when the inventions have been found to be previously described, and are, therefore, public property. The bogus inventor may still, under the new Act, appropriate public property and demand from the Patent Office that a patent monopoly shall be granted to him for the same. The framers of this Act, in their tender regard for the rights of the individual and disregard for the rights of the public, have merely provided that a reference to the patents which anticipate the alleged invention of the bogus patentee shall be inserted in his specification by way of notice to the public.

But even this small concession to the rights of the public appears to be begrudged by the supporters of the views which so strongly influenced the framing of the Patents Act, 1902, if we may judge from a letter and memorial forwarded to the President of the Board of Trade by Sir Lloyd Wise and published in the *Times*, March 27th. Objection is raised in this memorial to one of the new Rules which enables the Comptroller of Patents to insert a reference to anticipating patents at the end of a specification, when the applicant for a patent refuses to amend his specification so as to exclude or acknowledge the pre-existing subject-matter. Sir Lloyd Wise considers that the object of the new Act is "to afford, both to the inventor and to the public the benefit of an official examination as to novelty without, however, incurring the serious risk of inflicting injury upon an inventor by refusing a patent for alleged want of novelty, *or by making public adverse official opinions*." The public may well ask Sir Lloyd Wise what benefit they are to get for the large expenditure of public money on an examining staff. Sir Lloyd considers that the publication of erroneous conclusions of the Comptroller about the novelty of inventions would cause irreparable injury to inventors, "whereas nobody could be irreparably injured by failure to endorse upon an applicant's specification an adverse official opinion."

This last extract from Sir Lloyd Wise's letter is a good example of the fallacious principles of the school which he represents. Is nobody injured by the bogus patent which is used to blackmail manufacturers and illegally enhance the price of goods to the consumer? Is nobody injured by the company promoter who uses bogus patents to extract subscriptions from the unsuspecting investor? Sir Lloyd wishes to deprive this poor manufacturer and innocent investor even of the small protection of an official warning endorsed on the specification.

The surprising circumstance about this memorial is that it has been signed by some of our leading scientific and technical men. It will be observed, however, that most of these men are themselves inventors and patentees, and would naturally look at the question from the patentee-inventor's point of view. This point of view is, as a rule, purely selfish. The inventor does not wish, under any circumstances, to have his invention officially marked as more or less anticipated. He thinks that the official may make a mistake, as is quite possible. But, to reverse Sir Lloyd Wise's dictum, nobody would be irreparably injured by an occasional unfair official endorsement; the patent is not refused; the Comptroller's decision is not final, and may be reversed in a higher court.

It is satisfactory to see (*Times*, April 3rd) that a counter-petition, signed by an overwhelming majority of the leading patent agents, has been sent to the President of the Board

of Trade. This petition is strongly in favour of the official endorsement, as opposed to the reference inserted in the body of the specification. As they shrewdly point out, if there is no distinctive character about the official reference, all references in the specification inserted by the inventor himself will be suspect, and injure the sale of his patent.

It is to be hoped that the President of the Board of Trade will remember that he has to protect the interests of the non-patentee manufacturer and of the consumer, and that he will not be induced by these misguided memorialists to take a step which would nullify to a great extent the beneficial effects of the new Patents Act.

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The Liabilities of an Electric Supply Co.

WHAT is the use of the Electric Lighting Acts? What is the object of the Board of Trade regulations relating to the supply of electricity? These are questions which will probably suggest themselves to the minds of those who have studied the findings of the jury and the judgement of the Court in the case of Midwood *v.* the Mayor, &c., of Manchester. A report of this case appeared in our issues of March 24th and 31st. The case is the most important from the point of view of electric supply companies which has come before the Court in recent years.

The short facts of the case are as follows :—We have an electric lighting system laid down by the authority of Parliament, planned and manipulated by skilled engineers according to the most approved methods. Not only this, the method of laying mains and the system of supply adopted was in accordance with the Board of Trade regulations, and, as we understand, all the arrangements were approved, if not actually inspected, by the electrical adviser of the Board. What is the result of the case? The Manchester Corporation is held to have been guilty of negligence in giving a supply in the authorised manner, and of creating a nuisance in bringing its mains near to the plaintiff's house.

We cannot but think that in arriving at their decision the jury lost sight of one important fact—namely, that undertakers who supply electricity are not merely exercising a privilege, they are performing a public duty. It is their duty to grant a supply to every consumer in the district where their mains are laid, and to maintain the supply at the prescribed pressure. Just as a water company must supply water, and a gas company must supply gas, so those who undertake the supply of electricity must perform their obligation. While the maintenance of pressure may expose all the inhabitants of a town to an infinitesimal risk, failure to maintain that pressure may plunge a whole district into total darkness.

Taking a broad view of the matter, however, it is not surprising that the jury should award damages. The plaintiff undoubtedly suffered a serious loss, and it is natural that the jury should do their best to rehabilitate him. But in doing so they may have established a precedent which is somewhat disquieting for those whose duty it is to supply the public with electricity.

In discussing the legal position of the Manchester Corporation, we are not considering a mere exception to the general law. The same principles apply to every electric lighting company and local authority supplying electricity in the kingdom. Sec. 67 of the Manchester Electric Lighting Order is in the exact terms of Clause 77 of the Electric Lighting (Clauses) Act, 1899, which provides that :—

**The undertakers shall be answerable for all accidents, damages, and injuries happening through the act or default of the undertakers, or of any person in their employment, by reason of or in consequence of any of the undertakers' works, and shall leave harmless all authorities, bodies, and persons by whom any street is repairable, and all other authorities, companies, and bodies collectively and individually, and their officers and servants, from all damages and costs in respect of those accidents, damages, and injuries.**

Again, Sec. 70 of the Manchester Order is precisely similar to Clause 81 of the schedule to the Act of 1899, which provides that :—

**Nothing in the Special Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them.**

Having regard to the fact that both these clauses were under consideration in the case to which we are drawing attention, it really becomes difficult to see what benefit accrues to those who supply electricity under an Act of Parliament. Of course the authority of some statute is necessary to enable undertakers to turn up streets and lay their cables beneath them; but is there any other advantage gained? The undertakers are held liable for what has all the appearance of an inevitable accident. Do they take any benefit or derive any protection from the fact that their works are carried out under statutory authority? This is a question which we asked at the commencement of this article; in view of the decision in Midwood *v.* the Manchester Corporation, it seems that it must be answered in the negative.

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Amendment of the Workmen's Compensation Act.

AFTER the report of the Departmental Committee, which was published last year, it was expected that the Government would introduce a measure during the present Session for the amendment of the Workmen's Compensation Acts. This expectation has not been disappointed; and although the Bill, to some extent, increases the burden thrown upon employers, it will, at the same time, abolish many of the anomalies which have led to so much litigation in the past. Space does not permit us to draw attention to all the changes proposed. We should mention, however, that the question of the liability of a sub-contractor has been seriously considered, and it is proposed that, while the person employing the sub-contractor is primarily liable, the undertakers shall be entitled to be indemnified by the person by whom the workman was immediately employed and by any intermediate contractor, and any intermediate contractor called on to indemnify the undertakers shall be entitled to be indemnified by the person by whom the workman was immediately employed and by any contractor intermediate between him and that person, and so on; and any such indemnity shall, in accordance with rules of court, be enforceable in a County Court. The operation of the Act of 1897 is considerably extended by the expansion of the definition of the word "employment." This is to mean (*inter alia*) employment by the undertakers (1) on or in or about a railway, *tramway*, factory, *workshop*, *laundry*, *dock*, *wharf*, *quay*, *warehouse*, mine, quarry, engineering work, or *smithy*. The words in italics are new. The old distinction as to buildings exceeding 30 ft. in height is to be abolished, and the Act is to apply to work upon all buildings; it is also to apply to employment (i) in the process of loading, unloading, or coaling, or in painting or repairing any ship in any harbour or canal; or (ii) on or in or about any vehicle or vessel used for carrying purposes on inland waters; (iii) in the care or management of horses or locomotives. The word "railway," as used in the Act, is to be extended so as to include every station and siding of or belonging to the railway or tramway, while the words "engineering work" is to include any railroad, harbour, dock, pond, inland navigation, road, embankment, sewer, gas or water works, well, telegraphic line, or electric line or work, or part thereof, which is being made, laid, altered, repaired, demolished, or removed. "Telegraphic line" is to have the same meaning as in the Telegraph Act, 1878, and "electric line or work" the same meaning as in the Electric Lighting Act, 1882.

The Bill contains a seemingly anomalous proposal to the effect that workmen over 60, or workmen owing to some physical incapacity find it difficult to obtain employment, may contract out of the Act. This is the direct result of what has been pointed out by the secretaries of many friendly societies, namely, that owing to the serious liabilities imposed upon them by the Act of 1897, employers are unwilling to accept the services of men with grey hairs in their heads, or of men who, by reason of some physical infirmity, are more liable to be seriously injured by accident.

Having regard to the drastic nature of the changes which are suggested by the Bill, we apprehend that it will not go through the House without considerable opposition.

## THE BRITISH ENGINEERING INDUSTRIES AND THE FISCAL INQUIRY.*

### IV.—The Comparative Incidence of Tariffs.

In considering the effect of the Customs tariff of foreign countries and British possessions on the trade of the United Kingdom, it is evidently of the highest importance to obtain some measure, however rough, of the comparative level of the tariff barriers which impede our commercial intercourse with those markets. The difficulties confronting the Board of Trade have been so formidable as to have been previously considered insuperable. These difficulties were in part due to the extremely complicated nature of certain tariffs which are not devised on an *ad valorem* basis, and also even in the case of a country in which the *ad valorem* tariff differs with different commodities. The method adopted by the Board of Trade has therefore been to calculate approximately the mean *ad valorem* equivalent of the import duties imposed by each country on the main classes of manufactures which are exported from the United Kingdom *to all destinations*, and not solely to the particular market under consideration. This method has the advantage of applying a uniform standard to all countries, both as regards the list of articles on which the duties are calculated, and the relative "weight" attached to each article. It has the further advantage of taking into account the duties which exclude our goods from particular markets as well as those which are actually paid on such goods as gain admittance.

In order to apply this method of calculation, a list was prepared embracing the principal classes of goods exported, attaching a "weight" to each group approximately according to its comparative importance. Among the groups of articles which have been taken as representative of British exports of manufactures as a whole, are machinery, hardware, &c., to which a weight of 12 is attached, and iron and steel manufactures to which a weight of 16, and ships to which a weight of 3 is attached. That is to say, that of manufactures valued at 174·5 millions sterling and exported from the United Kingdom represented by 100, the engineering manufactures enumerated have an aggregate weight of 31. On this basis the following table has been computed :—

Estimated average *ad valorem* equivalent of the import duties levied by the under-mentioned foreign countries and British Possessions on the principal manufactures exported from the United Kingdom :—

| | Per cent. | | Per cent. |
|---|---|---|---|
| Russia ... ... ... | 131 | Canada (preferential tariff) | 17 |
| Spain ... ... ... | 76 | Roumania ... ... ... | 14 |
| United States ... ... | 73 | Belgium ... ... ... | 13 |
| Portugal ... ... ... | 71 | Norway ... ... ... | 12 |
| Austria-Hungary ... ... | 35 | New Zealand ... ... | 9 |
| France ... ... ... | 34 | Japan ... ... ... | 9 |
| Argentine Republic ... | 28 | Turkey ... ... ... | 8 |
| Italy ... ... ... | 27 | Switzerland ... ... | 7 |
| Germany ... ... ... | 25 | Australia ... ... ... | 6 |
| Sweden ... ... ... | 23 | South African Customs Union (preferential tariff) | 6 |
| Greece ... ... ... | 19 | China ... ... ... | 5 |
| Denmark ... ... ... | 18 | Holland ... ... ... | 3 |
| | | British India ... ... | 3 |

The interest of a general tariff such as the above is to the engineer more academic than specific. An examination, however, of the tariffs of the principal manufacturing and purchasing countries will perhaps be of interest to our readers. Taking first of all the several British Colonies and possessions in the order in which they appear in the foregoing table, the following notes are collected from pages 293—315 of the Second Inquiry Blue Book.

Canada.—The rates leviable on goods manufactured in the United Kingdom are 33⅓ per cent. less than the general tariff rates, except in the case of woollen goods. The actual *ad valorem* duties paid on articles of engineering interest are :—Textile machinery, 16⅔ per cent. ; locomotives, 23⅓ per cent. ; sewing machines, 20 per cent. ; pig-iron, 12 per cent. ; rails, 20 per cent. ; galvanised corrugated sheets, 16⅔ per cent. ; steel bars, angles and shapes, 3⅓ per cent. Ships are duty free. In spite of the much talked of preference, the Canadian tariff on British goods is higher than that of any other British colony or possession.

New Zealand ranks second in order of onerousness of colonial average import duty. There is for engineering articles a rather extensive free list, sewing machines, pig-iron, rails, tin-plates, and steel bars, angles and shapes being not liable to duty. Duties of 12½ per cent. and 16 per cent. are respectively charged upon locomotives and galvanised corrugated sheets.

Australia.—The unifying of Australia, which was effected by the establishment of the Commonwealth, has substituted a single comprehensive tariff for the diverse tariffs of the several component colonies. At present a tariff of 12½ per cent. confronts locomotives and rails. There is a provisional tariff of 6 per cent. on galvanised sheets, which is liable to replacement by a 10 per cent. duty when this particular manufacture is established in the colony. Steel bars, angles, shapes, &c., and pig-iron are similarly to be confronted by 10 per cent. duties. Even worse is the outlook for makers of textile machinery and sewing machines, which are to become liable to a 15 per cent. duty when their manufacture is established in the colony.

South African Customs Union.—The duty on sewing machines and on galvanised sheets is 7½ per cent. All other British engineering manufactures are duty free. A duty of 2½ per cent. *ad valorem* is levied on rails, locomotives and textile machinery not of British manufacture ; the rates levied on other dutiable articles, when not of British manufacture, are throughout 33⅓ per cent. higher than those quoted, making an actual impost of 10 per cent. on the goods mentioned.

British India.—Just as India offers the lowest average general tariff to British goods, so also does India offer the lowest tariff on engineering articles. There is a 5 per cent. *ad valorem* duty on sewing machines, but textile machinery and locomotives are duty free, while there is only a normal 1 per cent. duty on the various manufactures of iron and steel.

Of the various foreign countries in regard to which the average incidence of the tariffs has been computed, only a few call for comment in these pages. Those selected for mention, therefore, are notable either on account of the amazing value of the duty, or because of the manufacturing of the country imposing them.

Russia imposes the following duties :—Textile machinery, 28 per cent. ; locomotives, 39 per cent. ; sewing machines, 10 per cent. ; pig-iron, 91 per cent. ; rails, 90 per cent. ; galvanized sheets, 122 per cent ; tin plates, 110 per cent. ; steel bars, angles, &c., 42 per cent. Ships alone are free.

The United States under the present tariff charges 45 per cent. *ad valorem* on locomotives, textile machinery, and sewing machines, 26 per cent. on pig-iron, 30 per cent. on rails, 49 per cent. on galvanized sheets, 50 per cent. on tin-plates, and 36 per cent. on steel bars, angles, shapes, &c. The importation of ships is absolutely prohibited.

France imposes the following duties :—Textile machinery, 10 per cent. ; locomotives, 14 per cent. ; sewing machines, 11 per cent. ; pig-iron, 19 per cent. ; rails, 45 per cent. ; galvanized sheets, 39 per cent. ; tin-plates, 35 per cent. ; steel bars, angles, &c., 21 per cent. ; and ships, 1 per cent.

Germany imposes the following duties :—Textile machinery, 5 per cent. ; locomotives and sewing machines, 9 per cent. ; pig-iron, 16 per cent. ; rails, 23 per cent. ; galvanized sheets, 20 per cent. ; tin plates, 18 per cent. ; and steel bars, shapes, &c., 11 per cent. Ships are duty free.

In many of the foregoing cases the tax as imposed is not directly an *ad valorem* one, but amounts to so many roubles per pood, or dollars per ton, or francs per 1,000 kilogrammes, or marks per 100 kilogrammes. The values quoted above are, therefore, the approximate *ad valorem* equivalent based on the relation of the tariff to the average export price for each commodity ruling in 1902. Of course it must not be assumed that the figures given in the afore-quoted tables in regard to the equivalent of the duties levied are an absolute indication of the relative protective efficiencies of the several tariffs. As the compiler of this section of the Blue Book points out, the protective effect of a tariff is not necessarily proportionate to the average level of the duties, but also depends on many other factors, such as the comparatively advanced or backward state of the home industries protected.

* Parts I., II. and III. appeared in our issues of February 3rd and 10th and March 3rd.

A 25 per cent. duty in Germany may give as complete protection to a native industry as a 100 per cent. duty in a more backward country. A high duty may have no protective effect, if the article to which it applies, happen not to be manufactured in the country in question.

## CORRESPONDENCE.

*Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Where are Telephones Made?

In stating that they did not know who was the writer of the original letter to the *Standard*, does Mr. Brooker answer for his directors?

Having regard to the circumstances connected with this matter, the General Electric Co. are surely hardly qualified to join *British manufacturers* in thanking "Indignant" for the spirit which prompted his letter. We venture to state that had "Indignant" been in possession of the true facts of the case, his indignation would have been in another direction.

Since Mr. Brooker appears to be at a loss to know why the name of the General Electric Co. has been brought into this correspondence, we will again tell him, though we were under the impression that our letter of the 14th ult. was abundantly clear.

Our telephones, specified by the West Ham authorities, were made the subject of an attack upon us by an apparently patriotic person who considered that it was not fair that our instruments should be used when equal articles of *British make* could be procured from a Lancashire firm. Now, as the General Electric Co. were the only firm in Lancashire *professing to make* them, we were more than justified in mentioning their name, especially as we knew *for certain* that the table telephone, although purporting to be British made, was imported by them from the Continent. Apart from this, your correspondent ought to know that if the practice of offering a foreign made article as British made is carried on by any firm, it is only natural that sooner or later the matter must be brought to public notice.

Mr. Brooker's letter is certainly very misleading, and would give one to understand that the table instrument referred to has, for some time past, been manufactured by the General Electric Co. at their Salford Works. This is not a fact, and we challenge them to produce (if they can) 24 of the table telephones, and prove that they were manufactured throughout by them prior to March 17th. This, we think, should leave no doubt in the minds of your readers as to the entire truth of our statement.

**The Berliner Telephone Mfg. Co.**
I. B. Bianbaum, *Manager.*

London, E.C.,
*April 4th*, 1905.

---

As one who is interested in telephones, I have followed with amusement the correspondence on this subject in the local Press, the *Electrical Engineer* and the *Standard*. I see that it has now drifted to your columns, and I was somewhat surprised to read the "child-like and bland," not to say ingenuous, letter from Mr. Brooker, who, like Mr. Balfour, "does not read the papers." To judge from his remarks, he must live in a little world of his own up there in Salford, and, with your kind permission, I will enlighten him on a few points.

Really, Mr. Brooker, I cannot believe you are so innocent. Were you not writing with your tongue in your cheek, supremely conscious of the possibility that "Patriotic Englishman" and "Indignant" are closely related, if not one and the same person? Also that this remarkable composite character appears to pay rates alternately at Richmond and West Ham, or wherever else your telephones do not happen to be specified. Were you really so unguarded as to think that this ubiquitous and long-suffering ratepayer is not in business within 100 miles of Cheapside, and is willing to sell even German telephones if the manufacturers make it worth his while?

If you do not know all these things, for goodness sake run oop to Lunnon and have a look at that big city, where they will teach you how these things are worked.

Now, I do not wish to say anything against your telephones; they may be very good—I believe they are. But you must really remember that your firm first established their business by importing telephones, and other things, from abroad with the assistance of that blessed Free Trade that they now abuse so much. Since those days makers of telephones abroad have not stood still, and their telephones are really quite as good as yours. If you have any doubt about this, why—there is that offer of a committee of experts which I notice you forgot to write about.

Again, Free Trade, as you may know, allows us to choose our markets; and perhaps you have not read that the rates in West Ham are very high this year.

Therefore I say, if you are really so innocent as to all this, then do come to London and tell them that you think it is better to live and let live instead of trying to "down" competitors who are legitimately doing what others did before them.

And, finally, *dear* Mr. Brooker, please do not imagine in the solitude of your Lancastrian Lhassa, that the obtaining of commercial intelligence depends on the movements of old servants, as well might the P.O. and the N.T.C. be petty enough to complain about the knowledge of their requirements which your excellent productions exhibit.

**Tar-Baby.**

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### Tabloid Electricity.

In further reference to this subject, I may say that I am seriously disappointed at the lack of enthusiasm shown in regard to what I thought to be an epoch-making suggestion. A letter from Mr. Frank Broadbent on February 10th, proving that the notion was an old one, is practically all the encouragement I have received.

As my signature indicates, I am not an expert, but I know enough about electricity to wonder how on earth it is that a nest of accumulators can be placed under the back seat of a motor dogcart, which will carry the Sultan of Turkey 10 miles out and home, if, at the same time, it is impossible to light a street lamp or a table lamp from a battery placed in the base of it.

I wish one of your kind correspondents would explain this matter to me, in such simple and clear language as to prevent me from troubling you or anyone else further about the matter.

They need not be afraid of wounding my pride by stating elementary facts, as I am, yours obediently, a .

**Greenhorn.**

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### Schedule Prices for Electric Lighting Installations.

I was very much interested in "A Contractor's" letter in your issue of March 17th.

I should like to know his opinion on the result of the tendering for the assisted wiring for the Erith U.D.C.

In so tendering a specification has to be taken into consideration. This, of course, calls for the very best materials and stipulates:—"The minimum standard rate of wages of the district to be paid to all men employed, according to their class of work."

The report which you publish this week is absolutely correct, but, perhaps, it is not clearly understood by you that the firm whose tender has been accepted is not an "electrical" firm but a "building" firm, and there is no one connected with it that has had any training in this class of work.

Should you favour this letter with a portion of your valuable space, perhaps some of your readers might enable others as well as myself to understand—

1. How to undertake such work (keeping absolutely to specification) at such a ridiculously low figure, viz., 10s. 6d. per point, which price includes lamps and fittings.

2. How a firm not in the trade can possibly make a paying job of it, tendering as they do so far below those in the trade.

The estimated cost by the Council, I believe, was 13s. per point.

The effect of such cutting prices in this district is that consumers are in many cases dissatisfied with the cost of

consumption; therefore there are not so many people taking electric light as, in my opinion, there would be if competence and fair prices were the order of the day.

Referring to "Manufacturers'" letter of this week, I beg to say that the list of "Contracts Open and Closed," which appears week by week in the Review, is very interesting to me. My tenders often appear in these columns, and I am pleased to see them there, as, in estimating, I always endeavour as far as possible to tender a fair price, thereby attaching no shame. As a result of this, I am frequently a good distance from the lowest tender, but invariably the nearest to the engineer's estimate.

**An Estimator.**

### Publication of Prices Tendered.

I wish through the medium of your paper to add my plea to that of "Manufacturers," as it is my lot to prepare drawings and tenders to a great many specifications, and after a few weeks' patient waiting to receive what your correspondent truly terms a "curt" reply.

I am aware that for obvious reasons some consulting engineers do not wish the prices to be published, but I think that most of those who have any standing would not object to their publication, and although there may be some trouble entailed in getting the figures, yet I often see fuller particulars of results given in other papers than I see in the Review, and as your paper is, I think, the recognised advertising medium in the British electrical industry, this should not be.

**Draughtsman.**

### Localisation of Faults in Cables.

My attention has been called to a letter from one of your correspondents, "B. S. H.," on the subject of localisation of faults in electric light mains.

Having devised the test therein described, and used the same scores of times, perhaps you will permit me to point out one or two slight inaccuracies.

1. It is quite unnecessary to draw consumers' main fuses or open their main switches before making the test. Such a course would take a considerable time on a crowded network, and would be practically impossible in the middle of the night.

Perhaps this hint will enable "B. S. H." to save a lot of valuable time in the future.

2. The resistance of the fault does not enter into the calculations in any case, whether it be high or low.

If the resistance of the fault be very high, the testing current can be obtained by cutting the bank of lamps completely out of circuit, and applying the full voltage to the faulty cable.

Of course, the method fails if the main has been *completely* burnt asunder.

3. When the supply is not available at both ends a set of secondary cells is not required, as the current can be sent round the loop in the reverse direction.

Those of your readers who are desirous of obtaining further information on this method of localising faults and short circuits, will probably find an article on the subject in the *Electrical Magazine* for October and November, 1904, of some interest.

**F. C. N. Bergh.**

### 'Phones Across the Street.

One of my customers wishes to erect telephones in two of his premises on opposite sides of the street, the wires to cross the street. Can this be done without paying anything to the National Telephone Co.?

**F. G. Cooney.**

Dublin, *April 4th*, 1905.

[Certainly it can. The Postmaster-General is the licensing authority, but no licence is required provided that both premises are in the hands of the same person or firm. —Eds. E.R.]

### Manchester Corporation Lawsuit.

Although the decision seems fair enough, in the matter of the fire caused by the Manchester electric mains, the Corporation Electricity Department seems to have had a bad time at the hands of Midwood & Co.'s experts, and the finding of the jury is surely rather harsh upon those who control the splendidly equipped and cared-for outside arrangements.

It would appear that the initial fault (if fault there be in a very occasional accident) is surely due to the design of the system rather than to the method of carrying on the work afterwards, and this is evidently another example of excessive blame falling upon the shoulders of those responsible at the time of such an accident.

This style of thing has happened before, and upon other networks than Manchester, and, speaking generally, it is rough upon the men, who have inherited a bag-of-tricks (that would cost too much to be altered to suit modern ideas), and who, by hard work and careful planning, keep things going as well as possible, for them to be accused of negligence when the inevitable accident happens.

Those who know the Manchester Corporation Electricity Department well enough are aware of the smooth running and efficiency of the present *régime*, and can appreciate the endeavours of the officials to make the best of a system that has been handed down to them. This knowledge, however, may not extend beyond the immediate locality of Manchester, and I feel that it is only fair to ask you to give this letter equal publicity to the report of the law case in your last week's issue. I would add that I am not in the slightest degree connected with the Manchester Corporation; and I anticipate that there are many other disinterested persons who may write (or wish to write) you in a similar strain on seeing the report of the case in question.

**Honour Your Prophets.**

Manchester, *March 29th*, 1905.

### Telephones for Deaf Persons.

I notice in your last week's issue the following:—"Telephones adapted for use for partially-deaf persons. C. Nathan and J. J. L. Newland. 1,081. January 15th, 1904."

If you, or any of your readers, could give the writer any information about this, such as name of manufacturer, address of patentees, &c., he would be very grateful.

**G. N. T.**

## PARLIAMENTARY.

### Administrative County of London and District Electric Power Bill.

(*Continued from page* 546.)

On 29th ult. the examination in chief of Mr. Hobdern was concluded, witness handing in a table which he said showed that the Westminster Co. were now supplying at a price lower than that proposed by the Bill.

Cross-examined by Mr. Honoratus Lloyd, Witness said that he anticipated that the price at which his company supplied would in the near future be reduced to ⅔d. per unit. The Westminster Co. was supplying the London, Brighton and South Coast Railway Co. for the purpose of lifts, but not for traction purposes. He admitted that for such purpose the company could supply only to a limited extent. The average price paid for power during last year was 2·047d. per unit.

Mr. Stewart Bain, managing director of the London Electric Supply Corporation, Ltd., was then called. He said that the area of his company extended from Chelsea in the west to Greenwich in the east. A very large portion of the area was within the industrial area of the present Bill. The total capacity of the company's station was 10,000 kw., but they had a boiler capacity equivalent to 13,000 kw. They had space in their engine room for turbines if they were considered necessary. For some time past the company had been reducing the cost of production, and the first two months of the present year showed a reduction of 27 per cent. when compared with the corresponding period of last year. That was due to the increased demand. Last year the company supplied the London County Council with 6,000,000 units, and the contract was for three years. He anticipated that at the end of that time the demand from other sources would make up for the loss of the supply to the London County Council. The company had been doing everything possible to increase the demand for power, for which there was a very large opening in their district. He could not see that the new company would have any advantage over his company in the matter of generating power cheaply. His company had always been reducing its prices to meet the demand, and there had never been any application to the Board of Trade to compel them to do so.

Cross-examined by the Hon. J. D. Fitzgerald: Besides the power supplied to the L.C.C., the company last year supplied

475,000 units for power purposes at 1·80d. per unit. The company did not supply any railway company or dock. Questioned as to the coal used, Witness said that the consumption was 4 lb. per unit generated, and the company paid 10s. 3d. per ton delivered The works cost per unit last year was 1·12d., but this year it had so far been ·9d.

Prof. Kennedy, Vice-President of the Institution of Civil Engineers, &c., engineer-in-chief to the Westminster Co., and electrical adviser to the London County Council, examined by Mr. Balfour Browne, K.C., said that the companies could not afford to scrap their machinery for the sake of getting a supply in bulk at a cheap rate. The various stations of the companies were still working satisfactorily, and in every way they had concentrated with the idea of efficiency. Questioned as to whether Mr. Merz's methods would not be antiquated in 10 years' time, witness said that he did not think that three-phase generators would be in use in 15 years' time. In all probability we should have single-phase generators in general use by then. He saw great difficulty in the way of the promoters supplying existing undertakers, because of the necessary transforming. If the present companies had the disability of not being able to supply electricity to be used outside their areas removed, then they would be in a position to supply any railway company.

Cross-examined by Mr. Fitzgerald: He had had no experience of the actual working of turbines. He admitted that the cost per kw. generated by a reciprocating engine was higher than the cost of energy generated by a turbine, but for smaller stations he preferred the reciprocating engine. The cost of coal at the Westminster generating station was 19s. 4d. for sea-borne, and 20s. 11d. for rail-borne coal.

Mr. H. W. Sprunt, manager of the South London Electric Supply Corporation, said in cross-examination that the total units sold for power purposes last year, exclusive of a temporary supply to the L.C.C. tramways was 274,000. The capital cost of the station was £70 per kw.

Major Cardew, late electrical adviser to the Board of Trade, was then called. He said that he was a director of the London, Brighton and South Coast Railway, which was now considering the question of electrifying part of its system. He considered that the existing companies were quite able to meet any demands made upon them. He agreed with the opinion which had been expressed by the various companies, that the effect of Major Marindin's report was that the existing companies ought not to be disturbed during their period of tenure.

Cross-examined by Mr. Fitzgerald: The electrification of the Brighton Railway was only an experiment.

Mr. Seale, secretary-manager of the Charing Cross Co., said that his company had persistently endeavoured to push its motive power supply. In 1901 they offered to supply power to the L.C.C. for their northern tramway system, and they had also offered supplies to various local authorities at a low rate. None of the offers had been accepted, although they were lower than the rates at which the authorities themselves had been able to generate power. In January of this year he made an offer to West Ham of a supply for tramway purposes at $\frac{1}{12}$th of a 1d.

Colonel Crompton, R.E., for the Notting Hill Co., considered that Mr. Merz's estimates were entirely hypothetical. Mr. Merz must have made a mistake. In his experience it was in the stations of moderate size that the lowest cost of generation was found.

On 30th ult. Col. Crompton continued his evidence. All companies, he said, which took a bulk supply from the promoters would have to put down large accumulators in order to get a steady current. That would tend to raise the price to the consumer. The promoters had made no provision for their plant becoming antiquated, and now more than ever it was dangerous for electrical engineers to launch out too far in one direction, owing to the rapidity with which developments were being made. A sum should always be put by for depreciation. As to cheap coal, it always deteriorated rapidly in trans-shipment.

Cross-examined by the Hon. J. D. Fitzgerald: He had looked at the question from the point of view of what advantage his company would get by taking a supply in bulk from the promoters. The works cost of his company was ·715d., and in comparing that with the ·154d. of the promoters, it had to be remembered that it included the cost of distribution, whereas Mr. Merz's figure did not. He did not know that the Tyneside costs were ·04d. for the first two months of this year. He was of opinion that the actual costs could not be arrived at until the works had been in operation for some time. The plant at Newcastle was new, and no effects of wear and tear had yet been experienced. He did not think that the existing companies could ever hope to supply large users of power, because such users could generate more cheaply on their own works.

Mr. Highfield, the chief engineer to the Metropolitan Electric Supply Co., was then called, and in the course of his evidence remarked that the local factor was a very important feature in the cost of generation. The amount of coal consumed per unit generated by his company was 2·5 lb.

Sir Ralph Littler, K.C., addressed the Committee on behalf of the City Corporation. There were, he said, two companies in the City, both of which the Corporation had powers to purchase in 1914. Should this company be able to supply those companies at such a price that their generating stations—which were outside the City—might be discontinued, it might be that in 1914, the Corporation would only have mains to purchase, and they would be compelled to take their supply from the promoters of the power company. He asked that the City might be excluded entirely from the Bill, or that, at any rate, the promoters should not be allowed to come into the Corporation area without consent. He submitted, too, that the proposals of the promoters were altogether premature in view of the present condition of electrical science.

Evidence was then given by Mr. Philip Dawson, consulting engineer, in opposition to the Bill, on behalf of 16 local authorities over whose area the promoters asked for power to supply. Replying to Lord Robert Cecil, the witness said he did not believe that in actual practice the promoters would obtain the load factor which they anticipated, especially if they failed to get the tramway or railway load. He should say there was very little probability of their getting a tramway load, as all the existing tramway authorities possessed their own supply. As to railway companies, he thought they would prefer to erect their own generating stations rather than take it from the promoters, as they would be able to generate as cheaply, and there would be practically no additional cost for distribution. He absolutely disagreed with the estimates of Mr. Merz. They were far below anything that had yet been obtained in practice. If local authorities could secure a 35 per cent. load factor, they would be able to supply at ¾d. per unit.

Witness was cross-examined at considerable length by Mr. H. Lloyd respecting the accuracy of certain tables which he had put in, of the cost and price at which the local authorities manufactured and supplied their energy, but witness disclaimed any responsibility for the figures, which, he said, had been supplied by the various borough engineers.

Mr. C. H. Wordingham said that, speaking generally, the borough undertakings were just beginning to get the advantage of a large supply. They had large reserves, and he did not see why they should not be in as good a position to supply for all purposes as the promoters. The cost of generation was decreasing. If the promoters failed to get the large power users their case would go, and he felt certain that these, as represented by tramway and railway companies, would continue their present policy of making for themselves. The proposed competition would very seriously interfere with the local authorities, both as regarded their power and their lighting supply. He did not believe for a moment that the company would be able to supply at the price which they proposed.

On 31st ult. Mr. Wordingham was further cross-examined by Mr. Evan Charteris. He gave it as his opinion that turbines were merely a passing fashion, and would be superseded by gas engines for driving electric generators. Questioned as to the life of cables, he said that he did not think that cables were less liable to depreciation than machinery. In five years he had had to replace the whole of a very expensive system of cables. They were rubber cables, and at the time were considered to be the most up to date. He did not know whether mains could be purchased, guaranteed to last 20 years. As to the capital cost, he said that he agreed that if the size of the units was increased the capital cost was reduced, but only up to a certain point. He had designed a 400 kw. station which cost £8 per kw., excluding mains. He was averse to the use of very large generating stations under existing conditions in London.

Re-examined: He had examined Mr. Merz's estimates to ascertain what capital cost had been allowed for the transforming machinery. The sum which he found allowed was quite inadequate.

In reply to the Committee, Witness said that his fear of danger from the large ring main was a danger of explosions. As an illustration, witness mentioned an explosion which had occurred in Manchester some years ago. The main was comparatively a small one, but a fault occurred which set fire to the cable covering. The fire gave off a highly inflammable gas, and this finding its way into a cellar, ignited and caused an explosion. The main was carrying only 3,000 h.p. or 4,000 h.p.

Mr. G. G. Bell, electrical engineer to the Hammersmith Borough Council, was then called to explain some figures in Mr. Dawson's table, the average price for power at Hammersmith was 1·54d. per unit, the works cost last year being 1·6d. Capital cost per kw. was £40.

Mr. S. Baynes, electrical engineer to the St. Pancras Borough Council, was called, and said that the amount set aside for the relief of the rates out of the profits of the St. Pancras undertaking was £10,000. They had a reserve fund of £30,000. Last year the revenue from power consumers was £4,666. In a table handed in by witness it was stated that the power charge had decreased from 3d. per unit to 1d. The demand for power had increased some 100 per cent. since the price had been decreased from 2d. per unit to 1d. So far as pipes, &c., were concerned, St. Pancras streets were very much crowded.

Mr. P. V. McMahon, the engineer to the City and South London Railway, called, said that his company generated its own electricity at a total cost of ·675d. per unit. He anticipated that when the Euston extension was opened the cost would be reduced to ·611d. There was no advantage in a railway company taking a supply from an outside company. The generating station was the heart of the system, and, if a supply was taken from a company, all control over it would be lost. Most railway companies held that opinion. The works cost of his company was ·433d. This concluded the witnesses for the local authorities.

Mr. Freeman, K.C., then addressed the Committee. He said that very much the same arguments which had been used by counsel for the electric supply companies would apply in the case of the 16 local authorities which he represented. There was, however, this exception, that the companies were liable to purchase while the local authorities were not. It must be remembered that Parliament had given the local authorities power to invest the ratepayers' money to the extent of £5,500,000. As to competition, it was a fact that in no single instance had a company been allowed by the Board of Trade to compete with a local authority for the supply of electrical energy under a subsequent provisional order. Neither had a power company been allowed to compete with a borough council. The St. Marylebone Borough Council had been authorised to spend nearly £2,000,000 upon its electrical undertaking, and the

Council had also bound itself not to take electricity in bulk, should such a supply be needed, from anyone but the Metropolitan Electric Supply Co. Should the promoters manage to kill the Metropolitan Co., the Borough Council would be at their mercy. What had to be taken into consideration was this—Any loss which was likely to be incurred by the local authorities through the operations of the new company, would have to be borne by the whole of the ratepayers, and not only by those who were consumers of electricity. There was a possibility of the company applying for an extension of the industrial area if large factories were established in the non-industrial area. There was no evidence that the present supply companies were unable to give a supply on reasonable terms, neither had any witnesses been produced who had pledged themselves to take a supply. Further, as to the railway companies which the promoters anticipated to supply, he maintained that the trend of modern policy was for railway companies to manufacture all that their undertakings required. That applied to electricity as well as to rolling stock. All railway companies in England who had electrified their lines had their own generating stations, with the exception of the North-Eastern Railway Co. Coming to the finance of the Bill, he said that he would not for a moment dispute that aspect of the scheme. On the one hand, it was a source of strength to the promoters, and, on the other, a menace to the local authorities. The strong financial position of the promoters would enable them to supply for a certain period at a loss, so that they might kill competition. The local authorities who had no generating stations at present were largely interested in the prosperity of the companies in their districts. The effect of any ruinous competition upon the business of the companies, would, of course, be felt by the Councils when the time for purchase arrived. On these grounds he contended that the passing of the Bill would prejudicially affect the general public.

Mr. Blennerhassett, K.C., then addressed the Committee on behalf of Westminster. Dealing with the breaking-up of the streets, he contended that no such powers as those asked for should be given before the report of the Royal Commission on London Traffic had been issued.

Mr. John Hunt, the town clerk of Westminster, and Mr. Bradley, the City engineer, gave evidence to the effect that the Westminster Council had no objection to the supply in bulk to authorised distributors.

Mr. Lewis Coward, K.C., then addressed the Committee on behalf of the London County Council. He drew attention to the effect which the Bill would have upon the security of the vast sums of money which the L.C.C. had loaned to the various local authorities. The L.C.C. once introduced a Bill, in 1903, to transfer power of purchase of bulk undertaking to themselves, but that Bill was withdrawn on the request of the Government. Since then the Government had introduced two measures dealing with the matter; both of them had been dropped however.

Counsel for Stepney having addressed the Committee, the proceedings were adjourned.

On Monday, at the opening of the proceedings, a long discussion ensued on two returns which had been submitted to the Committee, one by the promoters and one by the opposition, showing the positions of all the existing power companies.

Mr. Tapper was then recalled and further cross-examined by the Hon. J. D. Fitzgerald. He did not know why in many of the Metropolitan Boroughs the charge for public lighting was higher than the charge for private supply, neither did he know how the prices charged in London compared with those of other large cities.

Mr. W. J. Bullock, chief engineer to the Corporation of West Ham, was then called as the first witness for the case of that authority. He said, in the course of his examination-in-chief, that the generating station was on the bank of the river. All the coal used was sea-borne. During the past 12 months there had been a large increase in the demand for power, and a new generating station had been erected. This station had a capacity of 8,200 kw. normal, the capital cost per kw. having been £20 5s. When the station was completed the cost would work out at £12 per kw. In the course of three years the output for power purposes had been doubled, and the sales this year for power had been 3,000,000 units. He estimated the total sales for the year at 6,168,000 units. During the present year the works cost was ·96d. per unit, the total cost per unit sold was 1·59d. The load factor at present was 16·8 per cent., but if the output was increased to his estimates the load factor would be 25 per cent. He did not consider that by 1910 any power company would be able to generate cheaper than the Corporation of West Ham.

Cross-examined by Mr. Honoratus Lloyd: He admitted that the chimneys at the new station were of steel, but he had not estimated for how much less than the £12 per kw. the station could have been erected if the Building Act had not applied. He agreed that even if the promoters could erect a station on those terms they would have done something better than anything hitherto done in London. Up to the present merely an experimental figure of 1·6d. per unit had been adopted for tramway purposes, as the actual figure had not been arrived at. Witness denied the suggestion that the cost of the new station had been put upon the lighting consumers on account of the power consumers, but he admitted that the station would not have been necessary for the present lighting load alone. The Corporation had had to consider an increase in the demand for power for the tramways.

Mr. Blain, manager of the Corporation tramways, having given evidence,

Mr. Morton addressed the Committee on behalf of the petitioners, contending that what the promoters wanted to do was to get into West Ham and do just as they liked. They would not be compelled to supply anyone whom they chose not to supply, and there was a prospect of the concern becoming a heavy charge upon the rates.

On Tuesday Mr. Forbes Lankester addressed the Committee on behalf of East Ham. He remarked in opening that not a single local authority throughout the area had come forward to support the promoters. In East Ham there were really only two large works where electricity was required, the Gas Light and Coke Co., and the London Docks, and both of them generated their own electricity. There would be very little demand for power, as the district was very largely a working-class residential one. If at any time any large demand for power should be made, the present generating station of the Corporation would be able to meet the demand for many years to come. In the course of his speech, learned counsel referred to the picking and choosing of customers which it had been alleged would be done by the promoters, and

The Hon. Evan Charteris (for the promoters) said that they did not admit that they would be able to do anything of the kind. They were under the obligations of the Electric Lighting Acts which had been incorporated in the Bill. It was the intention of the promoters to argue that they were bound by the Sec. 19 of the Electric Lighting Acts of 1882 to give a supply. It had always been the intention of the promoters that they should be bound. In reply to the Chairman, he said that they were quite willing to be bound, as the existing companies were bound to supply anyone who asked them.

Mr. Forbes Lankester pointed out that Sec. 19 referred to the preferential charging, and not to compulsory supply. It was Sec. 27 which dealt with that, and that section had been omitted from the Bill.

Mr. Charteris said that the promoters also relied upon Clause 30 of the Act of 1899.

The Chairman said that they would leave the matter for the present.

Mr. W. C. Ullman, electrical engineer to the East Ham Corporation, was then called. He said that the average price received per unit was 2·5d.; that figure included the supply to the tramways. The generating cost was ·9d. per unit, the total cost being 2·12d. per unit, and the capital cost being £32 per kw.

In reply to Mr. Charteris: The total revenue last year was £18,249, the revenue from tramways having been £6,872.

Mr. Mobesby White, on behalf of the Hackney Borough Council, addressed the Committee, and called Mr. Spencer Hawes, whose firm, Messrs. Robert Hammond & Son, designed the Hackney works. There were eight acres, he said, upon which 100,000 kw. could be installed. At the present time the installation was only capable of 3,752 kw., but the existing buildings could accommodate machinery for 6,332 kw. So far the capital cost of the station was £129,816, or £38 per kw. When the buildings had their complement of machinery, it was anticipated that the cost would have been reduced to £28. Their cost per unit sold in Hackney—1·04d.—was the lowest in London. Had they bought current from the promoters on the terms suggested in the Bill the amount of current which they generated last year would have cost them £1,000 more. On the other hand, if Mr. Meiz carried out his offer to supply Hackney with low pressure energy on the terms of his estimates, he (witness) had calculated that the price which the promoters would receive, after paying the cost of transformation would be only ·102d. per unit. It would have been a less sum than the promoters' coal bill. Witness said, in cross-examination, that there were three reasons why the price charged for public lighting was higher; (1) there was no diversity factor; (2) a large proportion of the time of the engineers was taken up; and (3) there was a separate system of mains for which no other supply was given.

The Committee adjourned.

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### Aberdare Tramways.

This Bill came before a Select Committee of the House of Commons, presided over by Sir Lewis McIvor, on Thursday last week.

In opening the case for the promoters, Mr. Wedderburn, K.C., said that the Bill was to authorise the Urban District Council of Aberdare to construct tramways and to carry out certain street improvements in connection therewith. There were five lines of tramways proposed, all of them short lengths of single line, with passing places. Tramways Nos. 1, 2 and 3 were parallel with the line of the Taff Vale Railway, and that company opposed the Bill. The estimates for and in connection with the construction of the tramways were together £66,880, while the amount proposed to be borrowed for the purchase of land in connection with the street widenings was £12,396. The cost of the tramways had been increased owing to a general desire to abolish a level crossing by a diversion of the road, but towards that the Glamorganshire County Council was to contribute £2,000. Where the line passed over the Taff Vale Railway the bridge would have to be widened.

Mr. Haun, chairman of the Tramways Committee of the Council and a mining engineer, was called, and spoke of the general desire for the tramways in the district, which had been expressed at a public meeting. In cross-examination, he admitted that he opposed the Bill of 1902, but explained that in that year it was proposed to cross the railway on the level. Replying to Mr. Noble, who appeared on behalf of the Taff Vale Railway, Witness said that he was not aware that the number of trains per day on that railway between Aberdare and Aberaman was 56. He knew that before the company instituted a service of motor-cars, the service of trains was only 10 per day.

Mr. John Jenkins, an employé of the District Council, who had at different times taken a census of the number of people passing

along various portions of the proposed route, and also by the motor-car trains of the Taff Vale Railway, spoke of the result of his investigations. He said that out of 96 trains advertised to stop at Dufferin, 12 did not stop. He admitted, in cross-examination, that some of the figures were taken during a "fair week," but the number of people passing on that day was not so large as on the following Saturday when there was no fair.

Other Witnesses having given evidence,

Mr. Owen Williams, engineer and surveyor to the Aberdare Urban District Council, was called. Examined by Mr. Hutchinson, Witness said that he was instructed last August to prepare the scheme for the tramways. The gauge of the tramways would be 3 ft. 6 in., which was the same as that of the tramways in the adjoining districts. The generating station would be in Aberdare, where they would get their power from the destruction of refuse. The refuse of the district was of a very high calorific value, as it contained a large amount of small coal from the collieries. The workmen in the collieries could obtain coal as cheap as 5s. per ton, with the result that quite a considerable quantity of small coal and dust was thrown away. The population of the district was 47,101, of whom 34,500 lived within 5 minutes' walk of the tramways. Taking the average as 90 times the population, the number of persons carried during the year would be 3,600,000. Witness then explained in detail to the Committee the nature of the proposed widenings. He estimated the cost of working at 4d. per car-mile.

On Monday evidence in support of the Bill was given by Mr. Stephen Sellon. He could see no engineering difficulties in the way of construction of the proposed lines. He estimated the cost of the equipment, generating station and the whole of the construction at £62,000. The revenue, taking a 10 minutes' service of 10 cars at a 15 hours' day, would, he estimated, be 10d. per car-mile. He put the working expenses at 66 per cent. of the income.

Mr. Alfred Baker, general manager of the Birmingham tramways, said that he had made an inspection of the proposed route on two occasions. He regarded tramways Nos. 1, 2 and 4 as the main line, a shuttle service being worked over Nos. 2 and 3. The total working expenses would be 6d. per car-mile.

Mr. Ram, K.C., then addressed the Committee on behalf of the frontagers' opposition.

On Tuesday witnesses for the frontagers were called.

Mr. Hopkins, an engineer, of Westminster, considered that the streets on the route were too narrow and the gradients too steep. He was of opinion that the tramways would not pay.

Mr. Walter Hopkins, M.I.E.E., a director of Edmundson's Electricity Corporation, said that he had inspected the proposed route. The route was very similar to that of the tramways at Camborne and Redruth, where the line had not paid so well as was expected.

The Chairman of the Committee complained that Counsel had not submitted a very lucid statement as to the financial portion of the scheme.

Mr. Wedderburn said that he had already called for the statement. In his judgement the real point was whether there would be any burden on the rates.

After the luncheon interval the statement was produced by counsel. It appeared from the statement that the promoters estimated a profit of £1,000 per annum. Mr. Wedderburn admitted that there would be a slight burden on the rates for the first few years.

A number of other witnesses having been called, the Committee adjourned until Thursday.

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### Ealing Corporation Bill.

This Bill was before Mr. J. W. Wilson's Committee of the House of Commons on Monday. Among the electrical clauses in the Bill was one providing for cases where energy supplied for motive power was used for the production of light.

Mr. J. D. Knight, engineer to the Corporation, examined by Mr. Gerald Fitzgerald, said that there had been several cases in Ealing where a consumer applied for current for motive power purposes, and after the necessary connection had been made, he had put down a motor-alternator, and had then used the current so taken for lighting his house. It was most unfair to the other consumers, who paid a higher price because they openly took a supply for lighting.

Replying to the Chairman of the Committee, Witness said that it did not always happen that the person taking a supply which he coverted for lighting, was a large power consumer. He knew of one case where it had been done at the house of a private doctor.

The Chairman: But the same thing occurs in gas works and all sorts of supply all over the country. I do not see anything peculiar in this.

Mr. Fitzgerald: But if the man uses appliances which enable him to use current supplied for one purpose for another—

The Chairman: You can raise your price to him for the whole, unless he will take two meters.

Mr. Fitzgerald said that there was a precedent for the clause in the Chesterfield Corporation Act of last session. Section 60 of that Act provided that any consumer so acting was not only liable to pay at a higher rate, but was subject to a penalty. In the present Bill they did not go so far as that.

The Chairman: But I am finding fault with the clause because it is self-evident that he must be liable to be charged a higher rate. If you were asking for a penalty it would be another question, but I cannot see that the clause gives you any new powers.

Mr. Fitzgerald (to the witness): Can you practically now charge him according to the use he is making of the power?—Witness: No.

The Committee having deliberated, the Chairman said: "It is simply a trading clause. You have power to charge under the Act for what you supply for." The clause was then struck out.

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*Woolwich Corporation Bill.*—On Wednesday and Thursday last week, Mr. Bill's Select Committee of the House of Commons considered the Woolwich Borough Council Bill, which by Clause 15 enables the Council on the one hand, and the local authority of any district which adjoins the borough, who may be authorised to supply electric current, to enter into agreement for the supply of electricity in bulk. Mr. Wedderburn, K.C., conducted the case for the promoters, but there was no opposition to the electric part of the Bill.

*Baker Street and Waterloo Railway Bill.*—This Bill should have come before Mr. Compton Rickett's Select Committee, but it was announced that the opposition had been withdrawn, and the Bill was accordingly removed from the list.

*Buenos Ayres Grand National Tramways Co., Ltd., Bill.*—The Lord Chairman of Committees of the House of Lords has reported that the above Bill has been withdrawn. The object was to amalgamate the Buenos Ayres Grand National Tramways Co., Ltd., and the Buenos Ayres New Tramways Co., Ltd.; to re-arrange the capital and deal with the arrears of dividend on the preference shares of the Grand National Tramways Co., Ltd.

*Metropolitan Railway Bill.*—The Committee of the House of Lords, presided over by Lord Onslow, on Tuesday last week, had before it the Metropolitan Railway Bill. The preamble of the Bill was proved by Mr. C. de W. Kitcat, solicitor to the company, who stated that the Bill authorised the amalgamation of the Harrow and Uxbridge Railway with the undertaking of the Metropolitan Railway Co., the consolidation of the capital issue of last year and of the present year into one 3½ per cent. convertible preference stock, and the granting of additional capital powers to the extent of £600,000. There was no opposition, and the Bill was ordered to go forward for third reading.

*West Cumberland Electric Tramways Bill.*—Lord Onslow's Committee of the House of Lords on Unopposed Bills on Tuesday last week had before it the West Cumberland Electric Tramways Bill, which seeks to further extend the period for the commencement of the construction and completion of the tramways and tramroads authorised by the West Cumberland Electric Tramways Act of 1901, and to extend the period limited by the West Cumberland Tramways Act of 1903 within which distributing mains for the supply of electricity were to be laid down. Formal evidence was given in support of the Bill, and it was ordered to be reported to the House.

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## LEGAL.

### Longman *v* The Bath Electric Tramways, Ltd.

This case came before the Court of Appeal, composed of Lords Justices Vaughan-Williams, Romer and Stirling, on Tuesday last week, on the plaintiff's appeal from a judgement of Mr. Justice Farwell.

It appeared that one Peter Bennett owned, under two transfers, 1,500 shares in the defendant company, and transferred them for value to Messrs. Horcalander & Moulden. The secretary of the company gave receipts for the transfers, and endorsed on the transfers a "certification," stating that the certificates had been deposited at the company's office, and the transfers were taken away by the broker. A few days afterwards the company's secretary, by mistake, sent the certificates to the transferer Bennett, and he borrowed money from the plaintiff upon a deposit of the certificates, together with a blank transfer of the 1,500 shares. In these circumstances the plaintiff brought the action against defendants for registration of the transfers of the 1,500 shares and delivery of the certificates, and for damages for the company's default. Plaintiff also alternatively claimed damages from the company to the amount of the value of the shares.—Mr. Justice Farwell held that the plaintiff had no cause of action against the defendants, and the Court of Appeal affirmed his decision.

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### City of London Lighting Co. *v.* Mason, Cattley & Co.

In the City of London Court on Tuesday, before his Honour Judge Lumley Smith, K.C., this case was heard, in which the plaintiffs sued the defendants, of Great Tower Street, for £9 12s. for electric current supplied.

Mr. D. M. Hogg, counsel for the plaintiffs, said the case was quite out of the ordinary run. The plaintiffs were suing for current supplied from July, 1900, to April, 1904. In 1894 the plaintiffs contracted with the defendants to give them a supply of electric light, and from then until 1900 there was no dispute between the parties. In 1900 the voltage of the company's current was changed, and the defendants' meter was changed. The reading of the plaintiff company's meter was, under their Act of Parliament, conclusive evidence of the total amount of electric current consumed by the customer, in the absence of fraud. A new meter was put in in 1900, but the meter did not represent on the face of it the amount of current consumed. It was necessary to multiply the voltage registered by the meter by its constant or multiple. The defendants'

old meter had had a multiple of ·02. The new meter, which was put in in July, 1900, had a multiple of ·04, just twice as much. Owing to a mistake in the company's office the books continued to show ·02 as the multiplier. The result was that for four years the defendants were only paying for half the electric current they used. The mistake was discovered in June, 1904, and although several letters were sent to the defendants, they answered none of them. There had been several mistakes of the same kind during the past year, and sometimes they were in favour of the consumer. The defendants' meter was tested by the City of London Electric Lighting Inspector, Mr. Voysey, and that showed that the defendants' multiplier was ·04. He could not see what defence there was.

Judge Lumley Smith: I expect the defence is that if you make blunders you must stick to them.

Mr. Hogg: That is not the law. The first man who took the defendants' meter readings is dead. The next man has gone to South Africa, but I can call the third.

Evidence having been given, Mr. Harper, for the defendants, submitted that the plaintiffs could not recover. He first pointed out the enormous inconvenience to consumers of electric lighting current, if they were to be called upon four years afterwards to pay suggested arrears. Books had been balanced, and accounts closed. The defendants' contract was a contract to pay what had been ascertained in a particular way. The company had sent in their accounts, and the defendants had done what was required of them in paying them. If a meter were found to be wrong, or any calculation were inaccurate, the company could not be compelled to pay the consumer beyond the preceding quarter. Therefore, the company ought not to be entitled to recover arrears for four years.

Judge Lumley Smith said he thought the electrical energy sued for had been supplied and not paid for. Therefore, judgement must be given for the plaintiffs, but without costs. He inquired whether the plaintiff company had ever refunded any money to anybody.

Mr. Hogg said they paid back the sum of £460 recently for a similar error the other way. They had several mistakes last year, and had settled them all.

Judge Lumley Smith: You must pay your own costs.

## EXETER ELECTRIC TRAMWAYS.

On Tuesday last the new electric tramway system at Exeter was opened with the usual civic ceremony. Shortly after noon five decorated cars drew up at the Guildhall and were promptly filled by public men and their friends, including the Mayor of Exeter and the Mayoress. Mingled with the hurrahs of the crowd were the explosive sound of detonators as the cars moved slowly up the picturesque High Street of Devonshire's cathedral city. The route lay up High Street and down Paris Street to Heavitree, where the chairman and members of the Urban District Council were taken on board. Returning as far as Queen Street, the journey was continued to the Great Western Railway Station at St. David's.

The cars drew up outside the Guildhall at the close of the trip, which occupied nearly two hours. The Mayor's chaplain pronounced a blessing upon the undertaking. The contractors presented the Mayor with a silver lever, and the Mayoress received a magnificent bouquet.

The Mayor, addressing the crowd from the top of No. 1 car, said it was a matter of very sincere congratulation to the whole of the citizens that they were bringing to a close a long matter of tramway construction and electric equipment in Exeter.

Within the Guildhall there was some brief festivity. "Success to the Trams" was duly honoured by a large company. The Town Clerk, in asking them to drink to the health of the Mayor, said it was owing to his enterprise at the start, and his persistence afterwards, that the establishment of the tramway was now an accomplished fact "The Health of Heavitree Urban District Council," co-partners in the undertaking, was also heartily pledged. The toast was appropriately acknowledged by Messrs. Wheaton, Mudge and Nethercott.

When St Thomas was annexed to Exeter under the Extension of Boundaries Act, and powers were given to re-build Exe Bridge, the subject of electric trams was brought prominently before the citizens, and at the November elections in 1900 the ratepayers, with no uncertain voice, pronounced in favour of the proposal of an electrically equipped service worked by the Corporation. Thereafter the Council was occupied for some time in determining upon the system of trams to be introduced. A deputation was appointed in 1902 to visit certain towns in England and on the Continent, and to report on the best scheme of tramways and other modes of passenger transit, including motor-'buses. The Committee visited Bournemouth, Southampton, Havre, Rouen, Paris, Dover, London, Birmingham, Wolverhampton and Bristol, accompanied by the city surveyor (Mr. Cameron), and (in respect to some of the towns) by the electrical engineer (Mr. Munro). They presented a voluminous report, which concluded with the recommendation that the electric trams to be introduced into Exeter and suburbs should be operated on the overhead trolley system, because of its economy and greater simplicity, and that it be adopted for all the tramways, with the exception of High Street and Fore Street. The scheme for these streets was left open for further consideration. Many residents in the main streets, and other citizens, favoured the introduction of the conduit system for the High Street, but eventually it was resolved to establish a uniform system. A Bill to construct and equip the new tramways, and to buy out the old horse trams, was promoted in 1903.

The construction of the track work has been carried out to the specifications of Mr. J. E. Waller, consulting engineer; Mr. Thomas Moulding, city engineer and surveyor; and Mr. H. D. Munro, city electrical engineer, acting jointly. The contractors for the tramways were Messrs. Dick, Kerr & Co. The car-shed has been built to the designs of the city engineer. The generating plant has been installed under the superintendence of the city electrical engineer, the contractors being the British Westinghouse Co., and Messrs. Bruce Peebles & Co., of Edinburgh.

The track, which is now nearly completed, is 4¼ street miles in length, and consists of 2⅓ miles of double line and 2⅓ miles of single line with passing places. The gauge is 3 ft. 6 in. The rails are steel, of the girder type, 6 in. in depth (90 lb. per yard). The foundation for the rails and paving is constructed of cement concrete 6 in. thick. In addition to this concrete underbed, the rails are packed up to the true alignment by fine cement concrete, averaging ¾ in. in thickness. The points and crossings were supplied by Messrs. Hadfield's, Ltd., of Sheffield, and are made of their patent manganese steel.

The steepest gradients are as follows: Fore Street, 1 in 11½ to 1 in 13; St. David's Hill, 1 in 16; and Pinhoe Road, 1 in 19.

The sharpest curves are at the corners of Queen Street and Paris Street, viz: 35 ft. radius.

We have already described in our issue of July 8th, 1904, the Exeter electricity works, where plant has also been put down for supplying power to the tramways. Lead-covered feeder cables run from the power station through stoneware conduits to section pillars. The trolley lines are double throughout, and are supported from sectional steel poles, which are arranged as centre poles, side-bracket poles, or span-wire poles, according to the requirements of the route. The swivelling trolley head is adopted.

There are at present 12 cars, built and equipped by Messrs. Dick, Kerr & Co. They are of the double-deck type, to seat 20 passengers inside and 22 outside. The stairways are of the semi-reversed type.

Each car has two electric motors of 25 H.P. each, and, in addition to the ordinary hand-brake, is provided with the Newell magnetic track brake; the Philipson patent lifeguard is fitted, also a patent folding step interlocking with the folding gate upon the platform in such a way that the step and gate open and close together.

The car-shed and offices, which are now approaching completion, are located at the bottom of Paris Street, which is nearly the centre of the system. The shed provides for housing 15 cars.

The approximate cost of tramways when completed throughout is:—Track, including wood paving, £34,000; overhead equipment, £4,700; feeder cables, £3,000; cars, £7,000; car-shed, &c., £5,700; additional generating plant, £4,000 = £58,400.

The boiler house now contains six water-tube boilers, fitted with superheaters, capable of supplying steam for 2,700 H.P.

There are at present installed four steam alternators of a total capacity of 1,300 KW. One 200-KW. steam-driven generator is provided for the tramway supply, and also a motor-generator of equal capacity.

A company of about 70 sat down to dinner at the London Hotel on Tuesday evening, the Mayor of Exeter presiding. After the loyal toasts, Mr. J. A. Lucas proposed "The Forces—Spiritual and Temporal." The Sheriff of Exeter (R. W. Walker King) replied, saying he hoped that in regard to the tramways the lion and the lamb would lie down together and make the undertaking a great success.

Mr. J. Stocker proposed "Success to the Exeter Corporation Tramways." He thought the ratepayers felt most strongly that whether they had to pay for the tramways in fares or in rates, they were determined to keep them, and to make the most of them.

The Mayor, in responding, said it had been a long and weary job fighting the tramway battle. They were greatly indebted to the engineers and contractors, to their friend Mr. Waller, who rendered such yeoman service in the House of Lords, and who had always been at their service since; to Mr Moulding (their engineer), and to Mr. Munro (their electrical engineer), and to the very able firm of contractors (Messrs. Dick, Kerr & Co.), and their representatives, Exeter owed a deep debt of gratitude. They had been carrying by the horse trams something like half a million passengers a year, which was very remarkable, considering that the trams began and ended nowhere. But, with a thoroughly-equipped system of electric trams, he believed they would find they had something that would not only be a financial success, but would ultimately become a very profitable undertaking, and so be, instead of a burden on the rates, a relief to them.

Mr. T. Linscott, J.P., proposed "The Engineers and Contractors," and alluded to the prompt and satisfactory manner in which the work had been carried out.

Mr. J. E. Waller, consulting engineer, in response, said there were two things about Exeter tramways to which he desired specially to refer. The first was that the Corporation purchased the horse tramways at a very good price, and they established a record, by having, under the able generalship of the town clerk, got the whole of the costs awarded against the company. It was the only case he knew of in which a corporation buying tramways from a company got the costs of the purchase against the company. The second record which Exeter established was that, by what he considered a very great stroke of wisdom, they decided to put aside the lowest tender in order to put the whole of the work in the hands of one firm. At the time he supported that measure firmly, and he believed now that most people would agree that it was the right course to pursue. He did not think they had paid more for their tramways than if they

had taken the lowest tenders, because the fact of having several contractors in the same place led to extras which had now been avoided. The result of the work of Messrs. Dick, Kerr & Co. had been very satisfactory, and the contractors, no less than the borough engineer and the electrical engineer, deserved great credit. The Mayor, as chairman of the Tramway Co., had really laid the foundation of this undertaking. Before sitting down, he asked the acceptance by the Mayor of a silver cigar box.

Responses were also made by Mr. H. D. Munro, electrical engineer, Mr. Windsor, and Mr. Mackintosh, Dick, Kerr & Co, and Mr. Moulding, city engineer.

Mr. J. W. Beal proposed "Prosperity to the City of Exeter," which was acknowledged by the Deputy Mayor (Mr. J. White) and Mr. J. A. Lonam; and "The Mayor," proposed by Alderman Commin, was the concluding toast.

## BUSINESS NOTES.

**An Arc Lamp Controversy.**—We have received from the "Regina" Arc Lamp Manufacturing Co. the following letter:—

"In your No. 1,415, we notice a paragraph referring to a letter of Messrs. Johnson & Phillips, in which they endeavour to dispute certain features which we claim as novel for the Regina arc lamp.

"We do not doubt the 'Ark' lamp is enclosed as described by them, but the important difference they omit to mention is that the Regina arc lamp is 'hermetically' enclosed. Herein lies the novelty claimed by us. The Ark lamp cannot be hermetically enclosed; if it were, it would burst.

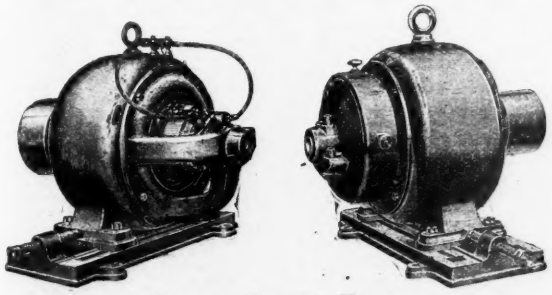
"The Regina lamp is fitted with a safety valve, which provides a means of escape for the gases generated while maintaining the highest pressure permissible. The Ark lamp has no such provision, and the gases must, therefore, escape somewhere and somehow, and, therefore, it is obvious that a high pressure cannot exist.

"The importance of this important structural dissimilarity is that the Regina lamp burns with one pair of carbons about 300 hours, and consumes 0·8 watt per C.P., whilst the Ark lamp burns about 100 to 150 hours, and consumes about 1·8 to 2·2 watts per C.P.

"Should Messrs. Johnson & Phillips dispute these figures, we are willing to submit our lamps to an impartial expert in order that they may be tested, and invite Messrs. Johnson & Phillips to do the same. The expert is to be nominated by you if you will kindly act so.

"Mr. Rudolph Grunhut, of Finsbury Pavement House, will supply any further information."

**Electric Motors.**—From Messrs. Durtnall & Pries, of 75, City Road, E.C., we have received details of their direct-current dynamos and motors, built in sizes ranging from ½ to 100 H.P., and in the open, ventilated, enclosed and totally enclosed types. The



Open and Enclosed Motors.

smaller motors are four-polar, and the arrangement of the end bearing plates permits of the machines being fixed either to wall or ceiling. The armatures are of the slotted-drum type, well ventilated, and the machines are designed to stand an overload of 25 per cent. for half an hour, and momentary overloads of 50 per cent. The larger machines are multipolar, and the bearings are lined with magnolia metal. The firm issues an illustrated list giving full particulars of prices, weights and specification.

**An Olympia Fire.**—During the recent great Automobile Show at Olympia, it was reported that a fire broke out on one of the stands owing to an electric cable fusing in a show case of the United Motor Industries. Arising from this, an action was brought by the United Motor Industries claiming £61 damages from the contractor for the lighting, Charles Oliver Clark (trading as Oliver Clark & Co., of St. Mark's Road, North Kensington), the counsel for the plaintiffs being Mr. Colam, and for the defendant Mr. Wootton. We are informed that the judge's remarks were in defendant's favour, and that when summing up he said:—"The issues of the case were of considerable importance to the defendant, he being an electrical engineer in a very large way of business, and his reputation was now at stake. It must be remembered that he laid on the electric light to 34 other stands at the Motor Exhibition without any fault being found in respect of any one of them." The expert evidence produced by the defendant left no doubt as to the cause of the fire, and although the trial had occupied the attention of the Court for two whole days, the judge did not think five minutes had been wasted. The result of numerous experiments was fully appreciated by the jury, who, after retiring for a quarter of an hour, returned and said they were of opinion that the fire was not caused through defective work on the part of the defendant, but through celluloid being placed in too close proximity to the electric lamps. His Honour accordingly gave judgement for the defendant on claim and counterclaim, with costs.

**Dissolutions and Liquidations.**—The Lodge Electric Light and Power Co., Ltd., is winding up voluntarily, as it cannot, by reason of its liabilities, continue the business. Mr. W. E. Mounsey, 3, Lord Street, Liverpool, is liquidator.

Creditors of the Electric Tramways Construction and Maintenance Co. are to send particulars of their debts, &c., to the liquidators (L. Morse and A. J. Paine, 79, Queen Street, E.C.) by May 9th.

Messrs. E. Bakewell and H. N. Bundy (Bakewell, Bundy & Co., electrical engineers, Narrow Street, Peterborough) have dissolved partnership. Debts will be attended to by Mr. Bakewell.

Mr. Arthur Whittaker, of Manchester, notifies that, in pursuance of arrangements which have been made, he has been discharged from the office of receiver and manager of the property and assets of Peter Pilkington, Ltd. The business will, from March 29th, be carried on by Mr. James Todd, C.A., as liquidator, and all amounts due to Mr. Whittaker as receiver will now be payable to Mr. Todd, by whom all liabilities which have been incurred by him will be discharged.

**Bankruptcy Proceedings.**—Under the failure of James T. Armstrong, electrical engineer, &c., Moorgate Street Chambers, E.C., accounts have been filed at the London Bankruptcy Court, showing total liabilities £6,933 3s. 8d., of which £4,845 7s. 7d. is expected to rank against net assets £11,947 4s. 9d., after deducting £194 8s. 1d. for preferential claims. The debtor filed his own petition on February 21st, and the first meeting of the creditors stands adjourned to April 13th to enable an offer to be submitted. According to the observations of the Official Receiver, the debtor states that for the past 10 years he has carried on business as an electrical engineer, and has been engaged on various inventions for wireless telegraphy and telephony, and the navigation of torpedo boats, for which many patents have been granted. In October, 1902, he assigned his patents (other than those for Norway and Sweden) to the Wireless Telegraph Co. which he then registered, having a nominal capital of £175,000, of which only £1,615 was subscribed in cash. The consideration payable to him as vendor was £120,000 in shares of the company, some of which he sold, and on account of which he received sums amounting to about £5,000, whilst a large number were transferred to other persons for services rendered. The company (of which he is managing director) has since been engaged in the construction, development and demonstration of apparatus and in attempting to dispose of licences to use its patents, but so far it has not been a financial success. The debtor attributes his failure to pressure by creditors; and to inability to readily realise his household effects (a large part of which consists of antique furniture, prints, curios, &c.), and to obtain repayment of moneys paid by him on behalf of the company. Creditors treated as partly secured are respectively stated to hold, against moneys advanced, a large number of shares in the Wireless Telegraph Co., and in three other companies. The shares in the latter companies were received by the debtor for services rendered, or in exchange for shares in the Wireless Telegraph Co. On the application of Mr. C. A. Pope, Assistant Receiver, the debtor's public examination was adjourned to April 19th.

At last Friday's sitting of the London Bankruptcy Court the public examination was held before Mr. Registrar Brougham, of Alfred Ernest Parker, lately carrying on business at 38, Conduit Street, W., as the Electrical Fittings Co. The statement of affairs filed by the debtor shows £36,140 5s. 9d. (unsecured, £9,675 9s. 3d.), assets valued at £4,075 1s. 3d. Replying to Mr. G. W. Chapman, Official Receiver, the debtor stated that in August, 1904, he sold the business to the Electrical Fittings Co., Ltd., which was formed to take it over. As vendor, he was allotted £12,000 shares in the company, which further agreed to take over and discharge existing liabilities to the amount of £1,700. That part of the contract was not carried out, and witness was eventually called upon to pay those liabilities, in consequence of which pressure he filed his petition. The debenture holders entered into possession of the company's property last December and had sold the property at a sum which left no return for the shareholders. The debtor was cross-examined at some length regarding his connection with the firm of Patman and Fotheringham, and eventually he was allowed to pass.

**Catalogues and Lists.**—From Messrs. Ludw. Loewe and Co., Ltd., 30—32, Farringdon Road, E.C., and Berlin, we have received a copy of their catalogue No. 3 for 1905. It is very nicely bound in book form, and deals very fully with the company's machine tools and gauges of which they produce a very large variety for all engineering purposes. Amongst the large number of tools illustrated and described are screw-cutting lathes, milling machines, bevel gear cutters, grinding and drilling machines, turret lathes, chucks, vices, arbors and reamers. Tables and diagrams of the Whitworth, C.E.I. standard, and the international system of metrical screw threads, together with details of dies, taps and tap wrenches are also given. This should prove a useful book to all engineers.

Messrs. W. & T. Avery, Ltd., Soho Foundry, Birmingham, have sent us one of their new lists of automatic coal scales. The list is nicely produced and fully illustrates and describes the apparatus.

From Herr Otto Schlee, Biberach a Riss, Wurtemberg, an illustrated sheet has come to hand, showing many art-metal electric light fittings.

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We have received from Messrs. Fuller, Macleod & Co., Ltd., Norfolk House, Laurence Pountney Hill, E.C., an illustrated leaflet describing Macleod and Plato's patent heavy type electric alarm bell for railways, mines, fire alarms, &c. It is designed to solve the difficulty experienced in actuating the hammer on a large bell so as to obtain the full volume of sound. The hammer is mounted separately from the armature; in effect it is a lever working on a pivot, and having a long and short arm. The long arm carries a heavy steel clapper, and the short end is connected by an adjustable phosphor bronze pull rod to the end of the armature, the clapper weight being spring balanced. The bobbins and armature, with the usual contact breaker and connections, are contained in a water-tight cast-iron case, the pull rod passing through a gun-metal gland lightly packed with cotton and grease, which prevents the access of water, moisture, or gas to the interior.

The Electrical Co., Ltd., 121-125, Charing Cross Road, W.C., have sent us another pamphlet, No. 132, which deals with generating plant, electrical equipment for ore handling, and electric power in rolling mills. It contains a large number of illustrations of the company's plant that has been installed in various iron and steel works, among which we note those of the Holwell Iron Co., Ltd., Messrs. Bolckow, Vaughan & Co., Ltd., and many Continental foundries.

From the Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C., we have received leaflets describing their new "Igranic" motor-starting rheostat. Dimensions and prices are given on the leaflets.

The Western Electric Co., of North Woolwich, have sent us one of their new hanging show-card calendars, with weekly tear-off slips. The design of the card is most artistic and interesting. It includes interior and exterior views of the company's works, also illustrations of telephones, cable sections, fans, and a complete calendar for the year as well.

Messrs. Siemens Bros. & Co., Ltd, have sent us a further batch of recent publications. These include specifications of plain, open and engine-base types of their G machines; a leaflet giving outputs, weights and dimensions of the company's F and F A motors ranging from 2½ to 58 B.H.P., open, protected, ventilated and fully-enclosed types; also a leaflet giving particulars of maximum and reverse automatic cut-outs for 50—2,400 amperes. In addition, a leaflet is to hand, describing their patent transport primary cell for ignition purposes; it combines the advantages of both wet and dry cells. It is a wet cell, and consequently the electrolyte can be renewed; but it is thoroughly closed, and, unless damaged, the liquid cannot escape. It contains no acid, and there is no creeping of salts. For motor cycles, three No. V. cells giving 4½ volts occupy only a small space, the total weight being about 8½ lbs. These cells are also suited for motor-cars. Size XII. weighs about 3 lb. 4½ oz. charged, three of which will give 4½ volts, and four cells 6 volts.

Messrs. Hughes & Stirling, of Clock House, Arundel Street, Strand, W.C., who are well known as refuse destructor builders, have issued a 32-pp. finely illustrated catalogue of the "Sterling" refuse destructor. Their destructors are at work in connection with electricity supply systems at Bermondsey, Heston and Isleworth, Hackney and other places, and in this catalogue there are photographic views of these undertakings, together with particulars of tests made upon them.

**Book Notices.**—"Modern Electricity." By James Henry and Karel J. Hora. London: Hodder & Stoughton. 5s. net.

"Telegraphy." By Sir W. H. Preece and Sir J. Sivewright. New edition. 18th impression. London: Longmans, Green & Co. 7s. 6d.

"Elementary Electrical Engineering." By P. T. White. Wigan: Strowger & Son. 4s 6d. net.

"The Mechanical Handling of Material." By G. F. Zimmer. London: Crosby Lockwood & Son. 25s. net.

The British Thomson-Houston Co., Ltd., has issued a 20-page brochure, got up in attractive style, describing and fully illustrating the Great Northern and City Railway, for which the company supplied so much plant and machinery. The matter is reprinted from the Electrical Review for January and February last year. We have no doubt that this publication will be very acceptable to many of the company's friends who wish to keep an account of this railway by them in handy form.

**Raworth's Traction Patents, Ltd.**—The Corporation of Plymouth has placed an order for six new cars with regenerative control for use on the new route to Pennycomequick.

The Scarborough Tramway Co., after six months' experience with three cars, has decided to proceed with four more, also to be fitted with regenerative control.

The Yardley route of the Birmingham Tramways is now fully equipped with 26 regenerative cars.

**Trade Announcements.**—Mr. J. E. Austin, electrical contractor, has removed from 40, Upper Baker Street, to 27, George Street, Portman Square, W.

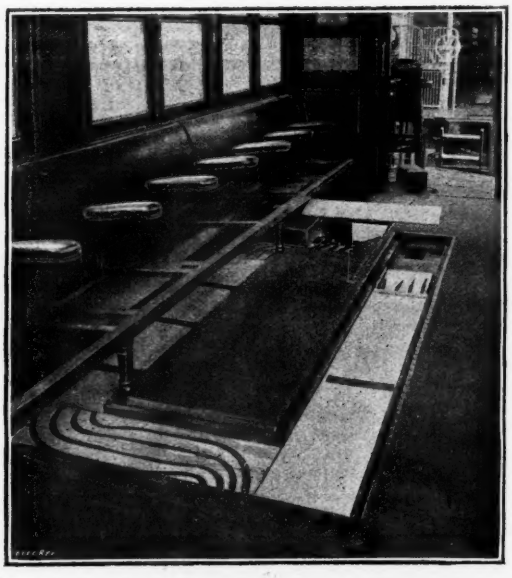
The Lister Electric Manufacturing Co. have purchased the entire business of Headley, Ltd., of Truro, with its various branches and agencies. The stock-in-trade, plant and tools are now being transferred to the Lister Co.'s works at Dursley, from whence the business will in future be conducted. The Lister Co. has established a new department, which will be under the direct personal supervision of Mr. Headley, for the supply of the various electrical supplies and accessories formerly manufactured at Truro.

**Meridian Lamp.**—We understand that the British Thomson-Houston Co., of Rugby, have, after a series of exhaustive experiments, developed a 120-watt "Meridian" lamp for burning in parallel on circuits of from 200 to 250 volts, which they are prepared to supply from stock. The attractive appearance and neat design of the Meridian lamp makes it suitable for interior decorative work where a downward distribution of light is required. The original 100—125-volt Meridian lamp was described in the Electrical Review of August 12th, 1904. The present lamp is similar in design; the shape of the filament, its situation in the

"Meridian" Lamp.

bulb, and the exact shape of the reflector, have been adopted after careful study, and are claimed to give the best distribution of light possible. The prismatic glass shade is accurately fixed to the lamp fitting, so that the Meridian lamp may be burned in any position with the same distribution of light as when arranged vertically.

**Asbestos Slate.**—We have received a sample of a fire-resisting and insulating material called "Calmon Asbestos Slate," which appears to possess properties of great value to electrical men. The "slate" is remarkably tough, and should be useful for lining junction boxes and fuse boxes, cable casings, distributing boards, &c. The accompanying illustration of the interior of one of the coaches equipped for the Metropolitan Railway by the British Westinghouse Electric and Manufacturing Co., Ltd., shows how the cables are carried under the floor in Calmon Asbestos Slate casings



Cables in Floor of Electric Coach.

thus obviating the risk of fire in case of breakdown of the cables. About 50 tons of the material was used for this purpose, and it was also adopted on the Mersey Railway electrification. These casings are made in slabs of any required size and thickness, and are provided with grooves to receive the cables. The material is very light, and can be easily cut and sawn or planed. It is manufactured by the Calmon Asbestos and Rubber Works, Ltd., of 6, Sheppy Place, Minories, E.

**Railway Signalling.**—It is stated that the South-Eastern Railway Co. has given a contract for £7,000 to the W. R. Sykes Interlocking Signal Co. to fit with electric signals the section of line between London Bridge and Grove Park, a distance of about a dozen miles.

## LIGHTING AND POWER NOTES.

**Aberdeen.**—The T.C. has granted the following privilege to users of energy for electric lighting:—Should a consumer on any particular occasion, and not exceeding once in each month, or three days at one time, require an extra supply of electricity, he may, by giving the Corporation 24 hours' notice in writing, have arrangements made whereby his indicator will not register the demand on the occasion so notified.

**Aspull.**—The Wigan T.C. has offered to take over the U.D.C.'s E.L. order, but declines to pay the costs of the negotiations in connection with the transfer. The U.D.C. has asked Wigan to pay half the costs.

**Bath.**—The T.C. has adopted the report of its Electricity Committee, which declined to waive its rights to have the 500-KW. generator supplied by Messrs. Dick, Kerr & Co., according to contract, or to release Mr. Manville from his obligations to the Committee as its consulting engineer. The Committee requires a substantial reduction from the contract price in consideration of the absence of a fixed lead as provided for in the specification, and also that Mr. Manville shall ensure that the economiser provided by Messrs. Babcock & Wilcox is in accordance with the requirements of the contract. The expenditure on extensions and additional plant at the works has exceeded the amounts for which loans have been sanctioned by the L.G.B. by £9,000. The expenditure on the boiler, chimney and steel flue, for which the sanction was £1,600, was £3,767; engine and boiler house extension and river wall, £4,119 sanctioned, and £5,484 expended; main switchboard extension with connections, £1,000 sanctioned, £1,831 expended; sub-station switchgear, £200 sanctioned, £2,275 expended; high and low-tension feeders and road work, excavation and re-instatement, and change-over work on consumers' premises, including meters, £4,500 sanctioned, £6,315 expended; extensions to low-tension distributors, together with the requisite house meters, cables, and boxes for services, excavation and re-instatement £4,500 sanctioned, £5,302 expended; engineers' fees and contingencies, £1,597 sanctioned, £2,304 expended. There was a saving of £900 on the steam generator and steam balancer for which £6,500 was sanctioned. The Council resolved to apply for leave to borrow the £9,000 excess expenditure. In the course of a discussion into this matter, the Committee accepted responsibility for £3,559, and that left £5,441 as being the excess for which Mr. Manville was responsible. The chairman of the Committee stated that it was to be regretted that the consulting engineer should not have been able to estimate to within 20 per cent. of a sum of that kind, and the only explanation he could offer was that in drawing up the specifications some very obvious necessities had been overlooked.

**Boston (Lincs.).**—With regard to the refusal of the L.G.B. to accede to the application of the T.C. for a loan of £20,000 for the establishment of electricity works, it seems that the plans have been returned by the Board, which requires a revised scheme on a broader basis, and the appointment of a consulting electrical engineer. In addition, the L.G.B. is not satisfied that the establishment of an E.L. installation in accordance with the scheme as at present designed, would be likely to be successful from a financial point of view, while it has not been satisfactorily shown that there would be any material improvement in the lighting of the streets, even with arc lamps as proposed, and the arrangement of the generating station is capable of considerable improvement, especially with regard to possible future extensions.

**Brighton.**—The Corporation's new generating station, now being erected at Southwick, has been much criticised. In view of this the T.C. has obtained a report from Mr. Wright, its consulting engineer, who states that there is not the slightest chance of the general body of the ratepayers having to contribute to the expenditure. The cost will be about £86,000 less than the £400,000 sanctioned. Mr. Wright points out that the electrical undertaking has been self-supporting from its first year of working, and that, if sold, it would, probably, realise twice as much as it had cost, and that Brighton consumes, per head, more electricity than any other town in England. Out of net profits the electricity department has also paid £14,000 in relief of the general rates.

The T.C. has decided to apply to the L.G.B. for a loan of £5,000 for the purchase of the Star Foundry for use as workshops and store yard in connection with the electricity works.

**Burnley.**—The Corporation Electricity Committee has further reduced the price of energy for the tramways from 1·45*d.* per unit to 1·375d.

**Burslem.**—The T.C., whose electricity works are approaching completion, has fixed the following scale of charges:—Lighting, 5d. per unit on the flat rate, and 7d. and 2d. on the maximum demand system; motors, 2d. per unit, or 10s. per quarter per B.H.P. installed and 1½d. per unit.

**Bury (Lancs.).**—The B. of G. has decided to put down an E.L. installation at the Workhouse.

**Cleckheaton.**—The Electricity Committee has recommended the U.D.C. to reduce the price of energy for lighting and motive power.

**Continental Notes.**—ITALY.—A concession has been granted for the erection of plant to utilise the water power of the River Grata Casols at Colobe (Brescia), for generating electrical energy for lighting and power purposes.

**Croydon.**—On the recommendation of the electrical engineer, the T.C. has accepted the tender of Messrs. Callender for the supply of cables for the next 12 months, but, owing to the high price of copper, it has been decided to make the contract on the sliding scale basis. The Council has also approved extensions of the D.C. and A.C. systems at an estimated cost of £4,289.

**Derby.**—The T.C. has applied for a loan of £9,600 for E.L. purposes. Of this sum £4,400 is for a 500-KW. turbo-generator and condensing plant, £3,000 for mains, £600 for services, £400 for meters and instruments, £300 for switchboard panels, and £500 for contingencies.

**Doncaster.**—It is proposed by the Corporation to expend £7,500 on extensions to the electricity works.

**Dover.**—The B. of T. has informed the T.C. that the prov. order applied for with the object of extending the lighting area outside the borough, will be granted for the parishes of River, Ewell, Whitfield, Guston, West Cliffe, and St. Margarets, with part of the parish of Alkham.

**Dublin.**—The Corporation E.L. Committee has issued a report dealing with the letter of the L.G.B. in regard to the recent application to borrow a further sum for plant extension. Mr. Mark Ruddle, the city electrical engineer, reporting on this, states that the increasing demand makes extension necessary, but that it is first advisable to consider the undertaking as a trading concern. The annual charges for repayment and interest on the capital commitment of £432,589 amount to £26,100. With the balance of the loan of £25,256 on the old undertaking, it would be hampered for the remainder of the periods of its repayment, but the rest, amounting to 20 per cent. of the total expenditure, would, in the natural expansion of business, become revenue earning in time. Nearly £5,000 per annum has to be repaid on, at present, unprofitable plans. This seriously handicaps the present position of the undertaking, but Mr. Ruddle is satisfied that it will be a yearly decreasing liability. It would have been wiser to have expended more of the sum available for mains in providing an adequate supply in the old area, under engineering conditions, admitting of easy and economical extension from the central district to the outlying parts. Overhead bunkers must be provided at the Pigeon House station, improvements must be made in the mechanical stoking of the boilers, two new trunk feeders from Pigeon House to Fleet Street must be provided; and generally a considerable outlay must be incurred in remodelling the distributing system in the old area, and in other parts of the system where profitable business demands it. A sum of £40,000 should be expended upon the generating and distributing system by the end of 1906, not including any provision for Clontarf. This should fully cover all necessary work, and is unavoidable if the increasing demands of customers are to be met. Mr. Ruddle recommends the following rates:—Motor supply, 5d. per unit, one hour maximum demand, and 1d. per unit after; alternative flat rate, 2½d.; special combined flat rate of 2d. per unit for motive power, and 3½d. per unit for lighting of newspaper offices. He considers that Clontarf should be treated as a separate concern, and concludes by suggesting extensions between the N.C.R. and Parkgate and Dorset Street and the vicinity of the South Dublin Union.

The Committee has also prepared a report, which states that much of the extension work at present confronting it could be satisfactorily carried out by the city electrical engineer and the local staff, and recommends the Council to determine the agreement entered into in 1899 with Mr. Hammond as from June 1st next.

**Dundee.**—Messrs. Gourlay Bros. & Co. are contemplating the introduction of electricity into their Camperdown Shipyard. To a meeting of the Dundee Tramways Committee last night a letter was read from the company, asking what charge would be made to bring a supply of energy to the yard.

**Egremont.**—The B. of T. has informed the U.D.C. that unless definite steps are taken this year to put the E.L. order into force, the order will be revoked.

**Gravesend and Northfleet.**—After lengthy negotiations, Gravesend T.C. and Northfleet U.D.C. have arrived at a definite decision with regard to the former's application for a prov. order extending the area of supply to Northfleet. The agreement states that Northfleet has withdrawn all opposition; if necessary, Northfleet's order shall be revoked; the prices for energy shall be the same as charged at Gravesend; Northfleet shall have the option of purchasing the undertaking at any time, by agreement; at the end of 14 years on giving 18 months' notice, at a fair market value, with an addition of 20 per cent.; at the expiration of 21 years on the same terms, with an addition of 15 per cent.; at the expiration of 28 years with an addition of 10 per cent.; and at the expiration of 35 years with an addition of 5 per cent.; for public lighting 100-C.P. lamps shall be maintained at £3 14s. per lamp per annum; and Gravesend is to pay Northfleet £250 in respect of the cost of obtaining the order. Only two members of the Northfleet Council opposed the agreement.

**Greenock.**—The T.C. and the Tramway Co. have agreed upon a revised scale of charges for electricity for the next five years, subject to certain conditions. The rates are as follows:—First 500,000 units, 1½d. per unit; next 200,000 units, 1¼d.; next 200,000 units, 1d.; and anything further, ·85d. per unit. The revenue from these rates is expected to amount to about £5,000 per annum.

**Halifax.**—The Electricity Committee of the Corporation has resolved that the sum of £3,402 be written off capital account in respect of plant now out of use at the electricity works, as follows:—Two 100-kw. E.C.C. alternators, and one 50-kw. E.C.C. alternator, £1,635; one 80-h.p. Robey engine, £267; transformers, £1,500

**Hoddesdon.**—The U.D.C. has decided to support the Bill of the North Metropolitan Electrical Power Distribution Co. for E.L. powers in the Council's area. The Council possesses its own order, which expires in December next, and the Bill referred to above contains a clause giving power to take over the order.

**Honley.**—With the object of increasing the number of consumers, which at present stands at about 40, the U.D.C. has decided to reduce the price of energy from 6d. to 4½d. per unit as from the 1st inst.

**India.**—Madras.—The Corporation recently considered the electric lighting scheme for Madras, in connection with the offer of Messrs. Crompton & Co., London. The company asked for a guarantee of not less than 2,500 hours of lighting annually. It was explained that, on the basis of 1,900 hours per annum, the present lighting hours, the Municipality would be able to light 4 sq. miles. On the basis proposed by Messrs. Crompton it would be able to light 3 sq. miles. After some discussion the Corporation decided in favour of lighting the larger area for the smaller number of hours, and the draft of the concessions to Messrs. Crompton & Co., was adhered to without the guarantee asked for.

**Lancaster.**—The price of electricity for motive power has been reduced from 3d. to 2½d. per unit.

**London.**—Lambeth.—Prior to the transfer in June last of the Lambeth area of supply of the Crystal Palace undertaking to the South Metropolitan Co., the B.C. suggested that it should be offered to the South London Electric Supply Co., so that the borough would be under two orders, and not three. The B. of T., however, refused to consider the proposal. Subsequently the South London company, being anxious to acquire the area in question, applied to the South Metropolitan Co. to give particulars of the value, &c., but the company refused to furnish these unless to the local authority under the purchase clauses of the order. The South London company, then asked the town clerk to obtain the information desired, but the town clerk explained that the B.C. was not in a position to apply for particulars unless the Council intended to become the purchaser at the price fixed under the order for 15 years from August, 1890, viz., a sum equivalent to the capital expenditure properly incurred with 33 per cent. added. Afterwards, the solicitors of the South London Electric Supply Co. wrote offering, if the Council gave notice of intention to purchase, to enter into an agreement to provide the funds for the purchase, and to indemnify the Council from all liability thereunder. Upon receipt of this the whole matter was referred to the General Purposes Committee. At the B.C. meeting on March 30th, a report was read from this Committee adverse to the proposal. The town clerk stated: "Whether the B.C. should undertake so serious a responsibility merely to assist the South London company was a matter for the Council to decide—indeed, it might be a question whether Sec. 70 was ever intended to give the local authority power to purchase merely to transfer such purchase to another company." The B.C. decided not to give notice of intention to purchase.

Hammersmith.—On Monday the Electricity Committee of the B.C. reported that the present method of charging private consumers for energy was on the maximum demand system at 6d. and 3d. per unit, the average price obtained being 4d. The electrical engineer had submitted an exhaustive written communication, pointing out that the Council in the course of a few months would be in a position to take on more than double the present number of consumers. In view of the fact that the charge for gas in the district had recently been reduced to 2s. 9d. per 1,000 cb. ft., he expressed the opinion that the time had arrived when a substantial reduction in the price of energy ought to, and could now, owing to greater economy in working, be made, and that if a flat rate of 3d. per unit were made, and if this had the desired effect of inducing consumers to install lamps in places where lighting was more frequently required, the Council might reasonably hope to make a profit of ·24d. per unit on an enormously increased output; but even if the output increased only along normal lines, it would be sufficient to meet all charges and show a reasonable surplus. The Committee, after due consideration, agreed with the engineer's report, with the exception that it did not consider it advisable to charge any meter rents. It resolved that the flat rate of 3d. should come into operation at the end of the next September quarter. The principle of the appointment of a canvasser, and the provision of a show room, was approved. £1,220 is to be spent on providing additional office accommodation and a workshop at the generating station. The borough accountant has prepared a statement of the income and expenditure (partly estimated) of the undertaking for the year ending 31st ult., showing a profit of £5,919 on the 12 months' working.

Woolwich.—The B.C. has resolved to give six months' notice to the South Metropolitan Electric Supply Co., to determine the agreement as to bulk supply of electricity to Eltham.

St. Pancras.—As a result of negotiations with the Underground Electric Railways Co. of London, Ltd., it has now been decided by the B.C. that a supply be given for lighting the stations in the Council's area, at a charge of 1½d. per unit, the price suggested by the company. A continuous consumption of energy for 23 hours each day throughout the year is guaranteed, the minimum number of units per annum at each station being fixed at 5,000, for a period of five years.

The Hampstead B.C. has suggested to the Council an arrangement to make the electric lighting areas in both their districts co-terminous with the borough boundaries, and it is being considered by the Committee.

Bermondsey.—At the B.C. meeting on Tuesday, the Finance Committee reported having passed an estimate of £6,159 for extensions of the distributing mains. In reply to a question, it was stated that the ultimate expense of opposing the Electricity Bills now before the House of Lords would probably amount to not less than £500 for each borough council. A letter was received from the B. of T. enclosing a description of an additional system proposed to be adopted by the London Electric Supply Corporation for the supply of energy. It was resolved to ask the Board that, before approval be given to the additional system, the Council might have an opportunity of appearing at an inquiry, as the additional system would enable the company to come into more direct competition with the Council's undertaking. The attention of the Board is also to be called to the fact that there is another company in the borough.

Westminster.—The Works Committee of the C.C. reported on Tuesday that it had received an offer from the St. James' and Pall Mall Electric Light Co., whose contract for lighting certain streets in the Parish of St. James' at £30 per lamp per annum for 66 lamps will expire in November next, to continue the contract for five years at £24 per lamp. The offer was declined, and a specification was prepared by the engineer for the provision and maintenance of 66 lamps giving a minimum c.p. of 700. The existing pillars and lamps are the property of the Council. The following tenders were received:—Gas Light and Coke Co.: Installation, £10; maintenance and lighting, £15 1s., subject to an increase or decrease of 9s. 6d. for every 1d. per 1,000 cb. ft. increase or decrease in price of gas for public lighting, which is now 2s. 2d. per 1,000 cb. ft. Kitson Light Foreign Supply Co. (oil light): Not using existing pillars and lamps, installation, £35 10s.; using existing pillars and lamps, installation, £15 10s.; maintenance and lighting, £14. St. James' and Pall Mall Electric Light Co.: Installation, nil; maintenance and lighting, £17. The Committee did not think it advisable to adopt the Kitson system of oil lighting. Acceptance of the gas company's tender would, it was observed, involve an expenditure of £10 per lamp for installation, but the company notified that it was prepared to accept payment of this charge in five annual instalments, free of interest. A petition had been received signed by 55 ratepayers in Regent Street and Piccadilly, stating that they hoped that serious consideration would be given to the proposal to terminate the contract with the Electric Lighting Co., pointing out that these thoroughfares are among the most prominent in the metropolis, and expressing an opinion that a change in the present system of lighting would be a retrograde movement. The Committee deemed it advisable that the use of electric light for the public lighting of the streets in question should be continued, and had accordingly (subject to the usual sanction) accepted the tender of the St. James' and Pall Mall Electric Light Co., Ltd., for five years from November 9th, next.

Islington.—The Finance Committee reported on Wednesday having passed an estimate from the Lighting Committee of £4,500 for the provision of six mechanical stokers, steel bunker, coal elevator and conveyor, &c.

**Manchester.**—The Electricity Committee of the Manchester Corporation met last week to consider the position brought about by the recent judgement, which made the Corporation liable for damage caused by an explosion, and in which its electric mains, under the conditions referred to in the action, were held to be "a nuisance." The Committee unanimously decided to give notice of appeal against the judgement of the Court.

**Marlborough.**—The T.C. has unanimously resolved to assent to the application of the local electric lighting company for a prov. order for electric lighting. The Council endeavoured to obtain a clause giving it the option to purchase the undertaking at any time on giving 12 months' notice, but the B. of T. decided that the option to purchase should not be until 21 years have expired.

**Motherwell.**—The T.C. has agreed to borrow £20,000 for a further extension to the electricity works, to meet increased demand for energy.

**Newport.**—A failure in the electric light supply occurred on Saturday last at the provision market, about nine o'clock, whilst it was crowded with people. The trouble was caused by a joint in Dock Street, which was put in about nine years ago, and had burned out. The seat of the mischief was found about 11.30, and the light restored at five minutes after midnight.

**Reigate.**—The T.C. has applied to the L.G.B. for a loan of £4,000 for E.L. extensions.

**Salisbury.**—The Countess of Pembroke opened on Monday an electrical exhibition at the County Hall, which is being organised by the Salisbury Electric Light and Supply Co. At the various stands the public is shown practical illustrations of uses to which electricity may be put. On the stage is fitted up a dining-room, drawing-room and bed-room, all of which are lighted and heated by electricity. Amongst the hospital appliances shown are the Röntgen rays, the Finsen light, light baths, and high-frequency apparatus. The use of electrical energy for power purposes is an essential feature, and many kinds of electric light fittings are also shown.

**St. Albans.**—The City Council has resolved that the draft deed of transfer from the Corporation to the St. Albans and District Electric Supply Co., Ltd., of its E.L. prov. order of 1898 as revised by the B. of T., be approved, and that the draft supplemental agreement as originally settled between it and the company be revised by inserting a new clause, empowering the company under certain conditions to supply electricity in the city from a generating station outside the boundary.

**South Africa.**—Johannesburg.—From the *Rand Ratepayers' Review* we gather that in what is known as the inner area, the system of supply is to be changed to continuous current on the three-wire system with a pressure between outers of 460 volts. A portion of the new plant has been installed, and supply was expected to be available during last month. The Council expects to be able to change over a large proportion of the present consumers in the above area to 230 volts, and to connect up new consumers in October next. In the outer area, or suburbs, alternating current is to be supplied for lighting at 200 volts; part supply will be available about June next, and new consumers will be connected up about 12 months after that.

**Sunderland.**—The T.C. has decided to extend the electric mains to the Scotia Engine Works, where current will be supplied to 48 arc and 58 smaller lamps.

**Tewkesbury.**—The B. of T. has granted the Corporation a prov. order for electric lighting and power purposes within the borough.

**Thirsk.**—The P.C. is dissatisfied with the lighting of the town by the Northern Counties Electricity Supply Co. Tenders for the public lighting of the town during the next season are to be invited from the same electricity company, and also from the Thirsk Gas Co.

## TRAMWAY AND RAILWAY NOTES.

**Ackworth and Lindsey.**—This scheme was the subject of a Light Railway inquiry at Barton recently. Mr. Danckwerts, in opening for the promoters, described the line which will start at Ackworth and terminate at Immingham, near to the authorised new dock. So far as the carrying out of the electric part of the scheme was concerned, a certain firm were prepared to undertake the work, and also to take a large interest in it. It was not proposed to cross any other railway except one light railway, and the only main road it would cross was one at Barton, leading to the Humber, and that was a "dead end." The railway would be 4 ft. 8½ in. gauge, and the chief object the promoters had in view was the picking up of light traffic in a district which at present had no outlet, and had not been considered by any other railway. The chief traffic which it was hoped to get was agricultural. Then there was a large number of brickyards on the Humber bank, and cement and other large industries, which at present were solely dependent upon the river for despatching or receiving goods. There were, too, several coal mines on the course of the line, which could not at present be worked because there were no railway facilities. The estimated cost of the line was £580,000, and the total mileage 53, and it would not compete with other lines, but act as a feeder to them. Mr. Shipton, the engineer, said that the district that would be served by the line contained a population of 45,000. The line would be worked by electricity on the latest principles. The Committee retired, and on their return they said that, considering the magnitude of the scheme, they should like to hear Mr. Danckwerts on the question whether it was not one that should go before Parliament. Mr. Danckwerts said no railway of its kind had yet been refused on the ground of its magnitude only. He had evidence of a character such as he thought would compel the Board of Trade to grant the railway. He submitted that it would be doing a great injustice to the promoters to stop the case at this point, and he asked the Commissioners to hear the evidence they had to bring before them. The Chairman said the remarks of Mr. Danckwerts had not altered their decision, and it was a case which must go to Parliament.

**Aston.**—The City of Birmingham Trams Co., Ltd., have approached the T.C. with the object of obtaining its approval to the company handing over their lease of the trams in Aston Manor to the Corporation of Birmingham, with which city Aston is contiguous. Locally (says our correspondent) it is presumed that that company find the minimum annual license of £1,250, combined with the disadvantage of not being able to run all their cars through to Birmingham, too heavy a luxury for their non-success before Parliament in 1903, when such a great effort was made by the company to obtain control of the Birmingham Corporation system. So far as can at present be obtained, the Birmingham Corporation has no present intention of relieving the company of their liabilities to Aston Manor Corporation.

**Bradford.**—In consequence of the increasing competition of the Corporation tramways the Midland Railway Co. has asked for an abatement in the assessment of its lines within the city. The committee has offered a reduction of £3,000, which will mean a loss to the Corporation revenue of £1,250. The earnings of the city tramways for the 12 months ended March 25th, show an increase over the preceding year of £31,363.

**Belfast.**—The directors of the Belfast Street Tramways Co. have issued a circular to the shareholders stating that the arbitrator, Mr. L. L. Macassey, has decided that the total amount to be paid by the Corporation to the company is £296,948, in addition to the Corporation taking upon themselves the liability for the company's debentures, which amount to £60,000. This is equivalent to an award of £356,948. The directors estimate that this will enable them, after paying off the preference shares at par, to make a distribution of about £10 15s. per ordinary share.

At a meeting of the Finance Sub-Committee on the 1st inst., a Union Bank cheque for £296,948 14s. 6d. was issued in payment of the award to the late Belfast Street Tramways Co., and subsequently despatched to the Parliamentary agents in London.

**Darlington.**—On the 31st ult. the Tramway Committee decided to discontinue the ½d. fares. This was the outcome of a report made by the tramway manager, which showed that there had been a loss of from £4 to £5 per week since the ½d. fare had been adopted. In conjunction with the abolition of the ½d. fares, it was decided to rearrange the fare stages. The Committee also had before it a report by the borough electrical engineer as to the cost of energy for the tramways. The cost of current since the inauguration of the system had been 1½d. per unit, based on the assumption that 300,000 units approximately would be used per annum. The consumption of current, however, had been found to be much greater, the actual figures being stated to have been 400,000 units. Consequently the question was raised whether or not the cost of current for the tramways could not be lessened. In the report from from the electrical engineer, it was stated that the actual cost of current worked out at 1¼d. per unit. If this reduction in charge is made, it will mean a saving to the tramway department of £800 per annum, which will reduce the deficit on the undertaking.

**East Ham.**—At last week's T.C. meeting an agreement was ratified, whereby the tramway from the eastern boundary of East Ham to the Ilford Broadway is leased for seven years from the Ilford Council to the East Ham authority at 6d. per car-mile run over the section. The East Ham Corporation is to be responsible for all third party risks occurring through the cars, while Ilford will be liable for accidents through defects in the permanent way and overhead lines. A clause provides that the lease may be reconsidered in the event of the horse tramways to Stratford being electrified.

**Glasgow.**—The manager of the T.C. tramways has been authorised to proceed with top-covers for an additional 100 of the present standard cars, of the design formerly agreed upon.

The manager has reported on the life-guards in operation on cars in Dundee, and the Tramways Committee have authorised him to fit a similar guard on a car at Coplawhill Car Works, with a view to its being inspected by the Committee.

The Tramways Committee has recommended for acceptance the offer by the Electric and General Assurance, Ltd., insuring the department for 12 months against third-party risks, and risks under the Employers' Liability and Workmen's Compensation Acts, for a premium of £15,000, the limit for any one accident to be £2,500, and their indemnity for the year to be £25,000. The premium is £1,000 more than that paid last year.

**Huddersfield.**—As an experiment, the design in vogue at Bradford has been adopted for the covering of one of the electric cars. Our correspondent says that the new pattern is a distinct improvement on the one at present in use, which was selected some time ago, when the Corporation—the first in the country to do so—decided to adopt top-covers.

On Thursday last week a mishap occurred to one of the generators at the tramways power station, Longroyd Bridge. The tramway service throughout the day was somewhat seriously interfered with, only half the usual number of cars being run.

**King's Norton.**—Opinion locally as to whether the Corporation of Birmingham or the Midland Trams Co. should have the lease of the trams has been for some time divided, but at the recent District Council elections the Progressives, who favoured union with the Corporation of Birmingham, were badly beaten, and it is thought that an agreement with the company may result.

**Leeds.**—The tramway accounts for the financial year just ended show that the total number of fares paid was 64,223,666, an increase of 3,484,432 on the preceding year. The receipts amount to about £295,000, or £17,000 more than during the previous 12 months. Twelve months ago the Corporation handed above £52,000 towards the relief of the rates.

**London.**—A discussion has lately taken place in the newspaper Press between Messrs. T. Tilling, Ltd., the omnibus proprietors, and Mr. Allen Baker, the chairman of the L.C.C. Highways Committee. The controversy is as to the respective merits of a motor-omnibus service run by private enterprise and the electric tramway system of the L.C.C. Messrs. Tilling contend that the tramways are not self-paying, and Mr. Baker has sent to us a copy of his reply, in which he endeavours to prove to, at any rate, his own satisfaction, that the Council's tramways have been entirely self-supporting from the first. We quote the following extracts from Mr. Baker's letter. He says:—

"Even during the years when the bulk of the tramways south of the Thames were been reconstructed for electrical traction, entirely disorganising the ordinary traffic (some of the lines being closed altogether), the tramways account has never been a charge to the extent of a single penny upon the rates. On the contrary, the tramways have already during the past eight years, paid from surplus

revenue in reduction of rates, after the provision of interest and sinking fund charges a sum of over £293,000, divided between the northern and southern systems. . . .

"During the four years from 1889 to 1903 the 48 miles of tramways north of the river, which are leased by the Council, earned as profit, after paying interest and sinking fund charges, £153,700; while the 24 miles on the south side of the Thames, worked by the Council itself, during the same period, provided, after paying corresponding charges, the sum of £72,900.

"During the period of reconstruction there was a deficiency in the southern tramways accounts of £2,250 in 1902-3, and of £8,284 in 1903-4. This result was brought about by the Council paying interest and sinking fund charges of £12,300 on expenditure incurred for reconstruction before a single electric car was run on the lines creating those charges. Moreover, during the first-named year, a sum of £11,000 was set aside out of revenue for the renewals fund for the horse lines which were, at the time, entirely disappearing. The result of this was to give to the Council as an asset in the way of a renewals reserve fund a sum of £30,750 at the commencement of electrical working, before any wear and tear had begun, and the 'account deficiency' is thus amply covered by assets more than corresponding therto.

". . . . As the period of reconstruction passes away, the 'account deficiencies' will entirely disappear, and it is important to note that the accounts for the present year show a very substantial surplus after the payment of the very heavy capital charges upon the lines that have been reconstructed. To the impartial expert, it would appear that the Council has surmounted the difficulties of traffic maintenance and organisation during the trying period that comes in the history of every horse-propelled tramways undertaking when improved methods of traction have to be applied to the lines, with remarkable success."

To these remarks Messrs. Tilling reply:—"That this £293,000 has not been received from the surplus derived from the lines worked by the London County Council themselves their own figures will prove; but it is obtained from the rent of the lines north of London which are worked by the North Metropolitan Tramways Co. From the figures of these accounts it will be seen that the tramways south of the Thames showed a loss on working of £2,200 in 1902-3, and £8,200 in 1903-4."

Mr. Baker has again replied thus:—"The £293,000 quoted by Mr. Tilling includes £80,192 from the lines worked by the Council. But it also includes items from the northern system two years before the southern system was being worked by the Council. Therefore, as a mere matter of correct comparison, I took four years when both systems were working. These four years showed £72,900 received from the 24 miles worked in the south, and £153,700 from the 48 miles worked in the north, applied in the relief of rates.

"The next item is an alleged 'loss on working' of £2,200 in 1902-3, and £8,200 in 1903-4. There is no such loss on working. The working account shows a surplus, but, these two years covering a period of reconstruction and consequent dislocation of traffic, the Council chose to charge, as a proper financial precaution against this surplus, certain items in respect of capital charges and renewals reserve, and thus produced an 'account loss' which, as explained in my previous letter, is more than covered by the assets therein charged."

The annual Parliamentary discussion has taken place this week regarding the proposal of the London County Council to run tramways along the Embankments and over the Bridges. The matter was before the House of Commons on Monday, on a motion to omit the clauses relating to Nos 1, 1a, 2 and 2a tramways from the Bill. After the debate 171 voted for the omission and 171 against, so the Speaker gave his casting vote against, in order that the matter might come fully before the Committee. The scheme has thus made greater progress than in any previous session, and we trust that there is still a possibility that after complete investigation by Committee, the House will this session give a more representative vote, with a decisive majority in favour of the proposal.

On Monday morning work was commenced for laying the track for the L.U.T. Co.'s Surrey extensions.

On the same day a new route was opened for the London County Council tramways in a service of cars between Westminster and Greenwich, *vid* Kennington and the Camberwell New Road. The new route will relieve the congested traffic in London Road and at the Elephant and Castle.

Chelsea.—The Law and Parliamentary Committee of the B.C. reported on Tuesday having received letters from the managing director and engineer of the London United Tramways, Ltd. These gentlemen intimated that in connection with the proposed extensions in Surrey the company would require to break up the roadway of the borough for the purpose of laying cables to connect the intended sub-station at or near Kingston with the central power station at Lot's Road. In reply to an inquiry from the Town Clerk, the company's representatives stated they claimed the right to open the roadway under Sec. 27 of the London United Tramways Act, 1901, and Sec. 27 of the London United Tramways Act, 1902. The Committee considered that it was not clear that the company was authorised by their Acts to execute the works proposed in the county of London, and the company did not appear to have given any notice to the Borough Council when their Bills were before Parliament. The Committee had therefore directed the Town Clerk to inform the company that they dispute their right to take the action proposed. Instructions had also been given by the Committee to the Council's solicitors to take counsel's opinion on the matter.

**Manchester.**—The parcel-carrying scheme of the Tramways Committee authorised by Act of Parliament, was inaugurated last Monday. The Committee has provided a complete set of parcel vans, road vans, and other accessories, as well as a special parcels staff. The principal depôt is in Birker Street, near the Royal Infirmary. The arrangements for parcels distribution and collection, all over Manchester and the district, as far as Oldham and the surrounding towns, are stated to be very effective.

**South America.**—*Buenos Ayres.*—The mayor has ordered La Capital Tramways Co. to immediately remove its overhead feeders in Calle San Juan.

The Tramway del Oeste, used for carrying meat from the slaughter yards to the various markets is to be electrified.

The Municipality has rejected the petition of the Buenos Ayres and Belgrano Tramway Co. to extend its lines to Chacarita and Villa Urquiza, stating that the concession should be only for 60 years, and not for 99 as asked, and also mentions the fact that the line to the latter place would run over the same route granted to Messrs. Sawyer & Lacaze. The proposed fares, 20 and 30 cents, were also considered too high.—*Review of the River Plate.*

**Southport.**—Several successful trials were made this week of the electric tramway on the Southport Pier, and it is calculated that there will be a saving of at least 1d. per car journey. The total length of the Pier is 1,640 yds. and the cost of the cars now in use on the tramway was about £600.

**The District Railway Employés.**—The District Railway employés have agreed to accept the amended terms, but protest against two principles: (1) Only one man in the motor room; (2) the payment of Sunday labour at week-day rate.

**Wednesbury.**—The Corporation has decided to purchase so much of the tramway undertaking of the South Staffordshire Tramways Co. as is within the borough, and as was authorised by the Staffordshire Tramways (Extension) Order, 1882, and the Walsall and District Tramway Act, 1884. The South Staffordshire Co. has also submitted to the Tramways Committee of the Corporation plans and specifications for the conversion from steam to electricity of the track between Wednesbury and Darlaston, on which the steam cars ceased running about 18 months ago. Inquiries in official quarters, however, show that nothing is known as to whether it is intended to re-open the line for traffic in the immediate future. The deadlock between the Corporation and the company, therefore, apparently continues, though negotiations still in progress may lead to a settlement of terms on which the lines shall be leased to the company. It is understood that the proposal to purchase is merely a formal step, necessary to preserve the rights of the Corporation.

**York.**—The Streets and Buildings Committee has recommended the T.C. to break off the negotiations with the York Tramways Co. respecting the purchase of the undertaking. The Corporation has offered £9,000, but the company refuse to sell under £12,000.

## TELEGRAPH AND TELEPHONE NOTES.

**Continental Telephone Lines.**—The *Elektrotechnische Zeitung* announces that an arrangement has been concluded between the telegraph administrations of Hungary and Servia for the establishment of telephonic communication between Buda-Pesth and Belgrad. The Hungarian administration will extend the double line between Buda-Pesth and Neusatz as far as Semlin on the Servian boundary, and from there the Servian administration will construct a line up to Belgrad.

**Gas Explosions in Telephone Boxes.**—Among the recent Parliamentary questions was one by Sir T. Dewar, M.P., asking the Postmaster-General whether his attention had been called to a recent action to recover damages for personal injuries sustained through the explosion of gas in a telephone inspection chamber fixed in the footway in Regent Street; and, seeing that both judge and jury had expressed the opinion that, in the interests of public safety, the accumulation of gas in these telephone inspection chambers should be prevented by a system of ventilation, whether he would state if he proposed to adopt the suggestion. Lord Stanley replied that the case had been carefully considered. He feared that ventilation of the inspection chambers was not practicable, as he did not think the local authorities would consent to his fixing ventilating pillars in the footways, and the owners of private houses would not allow him to carry pipes up the walls. Ventilating covers could not be adopted, because they would not keep the cables free from mud and water. He was proposing to lay down certain precautions to be taken by his staff when opening manholes in which the presence of gas was suspected; but so far as the facts were known to him, no precautions taken by his employés would have prevented the recent explosions in Regent Street.

**Korean Telegraphs.**—The *Standard* Tokio correspondent states that Korea entrusts Japan, in an agreement concluded between the two countries, with the administration of the telegraphs, post office and telephones. All the profits accruing from these sources are to be paid into the Korean treasury.

**Telephones in Mexico.**—Considerable changes are at present being made in connection with the telephone system in the city of Mexico. All the lines are being placed underground, and at the exchange red electric lamps are being adopted in place of bells to notify calls.

**Bengal Telephones.**—The Bengal Telephone Co., Ltd., has declared a dividend at the rate of Rs. 5 per share for the past year.

**Glasgow Telephones.**—The Assessor of Railways and Canals has fixed the valuation of the Corporation telephone undertaking for the year 1905-6 at £11,558 13s. 3d. The number of instruments now working is 12,236.

**Mexican Cables.**—It is reported in the *Telegraph Age* that the Mexican Telegraph Co. is negotiating for the laying of a new cable in the Gulf of Mexico, between Galveston, Texas, and Coatzacoalcos, Mexico. The laying of this cable was necessitated by the continued increase of traffic between the United States and Mexico, Central and South America.

After the new cable has been laid, the company proposes to divert the route of the existing cable between Galveston and Coatzacoalcos, and to land it at Vera Cruz.

It is also stated that the Central and South American Cable Co. proposes to complete the duplication of its system by the laying of a cable between Chorillos, Iquique and Valparaiso.

**Pneumatic Despatch.**—Speaking in the House of Commons on 29th ult., Lord Stanley said he was unable to see that any advantage for the postal service could be derived from the creation of a system of pneumatic despatch which would counterbalance the grave evils arising from the construction and maintenance of a new and extensive system of underground tubes. He, therefore, viewed with disfavour the proposals of the Bill, and was strongly of opinion that no such measure should be proceeded with until the Royal Commission which was considering the question of London traffic had made its report.

**Telegraphists' Wages.**—In a Parliamentary paper just issued Lord Stanley states that, from an examination of the evidence given before the Committee on Post Office Wages, which sat last year under the chairmanship of Sir Edward Bradford, and from a comparison of the present scales of pay in the Post Office with the rates of pay current in other employments, it appears that, speaking generally, there is no reason for raising the maximum of the present scales of pay either of the indoor force or of the postmen. There is, however, good ground for modifying and improving the scales in some respects. In the case of the male indoor force—sorters, counter clerks and telegraphists, telegraphists (London), sorting clerks and telegraphists (provinces)—the scale is a long one, the maximum not being reached in London till about the age of 37. At the age of 25 or thereabouts, when the responsibilities of a family make themselves felt in many cases, the officer is at a comparatively low point in his scale. It is now proposed to give to all men in the above-mentioned classes, except in the smallest provincial towns, a special increase of pay at the age of 25. This age increase will vary according to the classification of the office. The full financial effect of these and other changes will not be felt until some years have elapsed. The changes will come into force at the beginning of the financial year 1905-6, and it is estimated that the increased cost in that year will amount to £224,400. The average cost in later years, when there has been time for the new scales to have their full application, will amount to £372,300 per annum.

**The Venezuelan Cable Case.**—A Central News New York telegram states that the Venezuelan Supreme Court has decided that the French cable company has forfeited its contract by its failure to fulfil the terms of its agreement. On the other hand, the claim by the Venezuelan Government for damages for arbitrary acts of the company failed.

**The Telephone Agreement.**—The Central Committee of the National Telephone (Staff Transfer) Association has issued a letter to the Press drawing attention to certain facts in connection with Clause 8 of the agreement which is about to be considered by a Select Committee of the House of Commons. The letter says:—

"The clause provides that, although 'it is probable' that the Postmaster-General will be prepared 'to take into his service a considerable proportion' of the company's staff, the Postmaster-General 'will not accept any obligation to recognise service under the company as giving any officer or servant any claim to consideration at the hands of the Postmaster-General either as regards service, emolument, pension, gratuity or compensation.' It should also be noted that, under the provisions of the clause, any member of the staff who might be placed upon the permanent establishment of the Post Office, would, for superannuation and other purposes, lose the benefit of his service with the company.

"The result of the clause would be to place every member of the staff, which numbers upwards of 13,000, in a position of great doubt and anxiety which must of necessity not only militate against the progress and efficient working of the telephone service, but also prevent the members of the staff who remain in the service under such uncertainty from making ordinary and proper provisions as to their future.

"As the clause now stands, every member of the staff, both present and future, is bound to look upon his position as being a temporary one, and such a state of affairs is not conducive to the best qualified and ablest men remaining in or entering the telephone service. . . . The result of the labours of the present staff has been that, in addition to the payment to H.M.'s Postmaster-General of a royalty of 10 per cent. on the gross revenue (the aggregate of such royalties amounting to over £1,500,000), satisfactory dividends have been paid to the shareholders of the company. . . . It does not seem just or desirable that a staff which has achieved this, and in so doing has, owing to the special and highly technical nature of the business, seriously prejudiced its chances of finding suitable employment elsewhere (the telephone service having become a monopoly in the hands of the Postmaster-General), should be harassed by the possibility of being thrown over in 1911, or of losing the benefit of its services with the company.

"Since 1896 all members of the staff receiving a salary of £100 per annum and upwards have contributed 2½ per cent. of their salaries to a pension fund with a view of making a provision for their old age, the company contributing a like amount, and the effect of the agreement as it now stands would be to defeat this object, whilst at the same time depriving those who are taken into the permanent employ of the Postmaster-General of the benefit of their service with the company.

"It is submitted that the precedent created by Section 47 of the Metropolis Water Act, 1902, should be followed as closely as the circumstances of the case will permit, and that members of the company's staff receiving at the time of purchase a salary of £100 per annum and upwards, or occupying a post or office which, if occupied by them in the permanent Civil Service of the State, would entitle them to a superannuation allowance, should come within the scope of the Superannuation Acts, 1834—1892, for the purposes of superannuation and compensation.

"It might be suggested in some quarters that the Postmaster-General could be saddled in 1911 with salaries which may have been inflated or created unnecessarily between now and that date. This, however, could be met by a list of the existing salaries being furnished to the Postmaster-General, and the question whether such salaries have been unnecessarily inflated or additional salaries created unnecessarily might be left to arbitration. . . . .

"The staff do not so much desire compensation as continuity of service on similar conditions, and would be willing to hand over to the Postmaster-General the sums forming their pension fund to deal with as he thinks fit, subject to any obligations attaching thereto under the terms of the deed creating the fund."

In the House of Commons on Wednesday some reference was made to the above matter. Lord Stanley said that he hoped shortly to be able to receive a deputation. The agreement had been signed and could not now be modified. It was open to the House to refuse to accept it.

## Telegraphic Interruptions and Repairs:—

| Cables, | Interrupted. | Repaired. |
|---|---|---|
| Trinidad-Demerara (No. 1) | Aug. 26, 1901 | |
| Dominica-Martinique | May 7, 1902 | |
| St. Lucia-Martinique | May 7, 1902 | |
| Cayenne-Pinheiro | Aug. 13, 1902 | |
| Beissa-Issa (Yemen) Camaran | Oct. 22, 1902 | |
| Tarifa-Tangier | Jan. 18, 1904 | |
| Closed { Vladivostok-Nagasaki | Feb. 9, 1904 | |
| Closed { Port Arthur-Chifu | Mar. 9, 1904 | |
| Jamaica-Colon | Jan. 5, 1905 | |
| Martinique-Paramaribo | April 2, 1905 | |
| **Landlines.** | | |
| Puerto-Barrios | July 28, 1902 | |
| Kertch-Soutehoum | Sept. 27, 1904 | |
| Bhamo route beyond Tali | Jan. 15, 1905 | |
| Newfoundland—all places in the interior | Feb. 10, 1905 | |
| Rome-Pera | Mar. 22, 1905 | April 1. |

**U.S. Panama Cable.**—According to the *Revue Electrique* the United States Government decided on December 8th to lay a cable between that country and the Isthmus of Panama. The necessary funds have already been voted. The cable is to be of American manufacture, provided the price of American manufacturers does not exceed that of foreign manufacturers by more than 10 per cent. The rate per word has been fixed at 75 centimes. Government and Press messages are to be sent at reduced rates.

**Wireless Telegraphy.**—The following coast stations are now open day and night for the receipt of telegrams by wireless telegraphy from ships at sea, which may be forwarded by the German Imperial telegraph system:—Rixhoeft, Marienleuchte Bulk, Arcona, Heligoland, Cuxhaven, Borkum Lighthouse and Borkum Shoal light ship.

## CONTRACTS OPEN AND CLOSED.

### OPEN.

**Aberdeen.**—April 19th. Surface condenser, &c. See "Official Notices" March 24th.

**Africa.**—May 15th. The General Government of French West Africa at Dakar, is inviting tenders until May 15th, for the establishment of a central electric lighting and power station at Dakar.

**Batley.**—April 17th. Tramway reconstruction, permanent way, overhead equipment, cables, conduits, &c. See "Official Notices" March 24th.

**Belgium.**—April 12th. The supply to the Belgian State Railways of materials for electric lighting. A copy of the general and special conditions may be examined at the offices of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

**Bournemouth.**—April 20th. Steel poles, overhead line, section boxes, &c., for the tramways. See "Official Notices" to-day.

**Cardiff.**—April 17th. Extra high-tension three-phase main switchboard, sub-station switchboards, motor-generators, rotary converters &c. See "Official Notices" to-day.

**Clyde.**—April 10th. Electric power plant for Clydebank Dock. See "Official Notices" March 10th.

**Devonport.**—April 18th. Surface condenser with electrically-driven pumps. See "Official Notices" to-day.

**Dewsbury.**—April 17th. Tenders are being invited for the relaying and electrical equipment of the steam tramway system between Dewsbury and Gomersal:—(1) Permanent way construction and paving; (2) overhead equipment, steel poles &c.; (3) feeder cables, conduits and accessories.

**France.**—May 14th. Tenders are being invited until May 14th, by the municipal authorities of Dax (Landes) for the concession for the electric lighting of the town during a period of 35 years. Tenders are to be sent to La Mairie de Dax (Landes), whence particulars can be obtained.

**Glasgow.**—April 17th. Main cables, meters and carbons for the Electricity Department for one year. See "Official Notices" to-day.

**Hull.**—April 17th. Air-spaced telephone cable for the Council. See "Official Notices" to-day.

**Johannesburg.**—April 27th. Switchboards and accessories for the new direct and alternating current power station. See "Official Notices" March 31st.

**Johannesburg.**—May 7th. Tramway poles, feeder pillars, overhead material, telescopic ladders, motor tower wagon, &c. See "Official Notices" March 17th.

**Le Touquet and Paris Plage.**—Offers are invited for the electric lighting concession for these two resorts. See our "Official Notices" March 31st.

**Luton.**—April 15th. Plant extensions for the electricity works. See "Official Notices" March 31st.

**Nuneaton.**—April 10th. Cables and joint-boxes for the electricity department. See "Official Notices" March 31st.

**Penang.**—April 18th. A 300-KW. steam dynamo, motor generator, balancer, switchboards &c., for the Municipal Council. See "Official Notices" March 31st.

**Stockport.**—April 26th. One 500-KW. steam-driven generator. See "Official Notices" to-day.

**Swindon.**—April 17th. Electric motors for three years. See "Official Notices" to-day.

**Wimbledon.**—April 28th. 1,000-KW. steam-driven turbo-alternator with condensing plant, switchgear and pipework. See "Official Notices" to-day.

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### CLOSED.

**Barking.**—The U.D.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a boiler, feed pump, water softener and storage tank at the Electricity Works, at £1,638.

**Bolton.**—The Corporation has placed an order with the Key Engineering Co., Ltd., for Cowan-Andrews remote control switchgear, for its high-tension three-phase extensions, amounting to £466 10s.

**Croydon.**—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for the supply of cables for the ensuing year.

**Derby.**—The following were the tenders received by the T.C. for the extension of the electric tramways from the Market Head to the Kedleston Road boundary and the connecting link between the Upper Dale and Dairyhouse Road terminus:—

| | |
|---|---|
| W. Griffiths & Sons, London (accepted) .. .. .. | £18,689 |
| A. Krauss & Son, Bristol .. .. .. .. .. | 18,888 |
| Brush Electrical Engineering Co., Ltd., Loughborough | 18,892 |
| G. F. Tomlinson, Derby .. .. .. .. .. | 19,098 |
| G. Holloway, Wolverhampton .. .. .. .. | 19,314 |
| W. Underwood, Dukinfield .. .. .. .. .. | 19,448 |

**Glasgow.**—The Stores Committee of the Tramways Department of the T.C. has recommended for acceptance the following offers:—

Finished brass work, John Stewart & Co., Ltd.
Cast-iron brackets and enamelled plates, Mr. William Landell.
Enamelled collars, Mr. William Landell.
Chubb's till locks, Do.
Timepieces, R. Anderson & Co., Ltd.
Springs for Newell brakes, L. Sterne & Co., Ltd.
Motors, the Western Motor Co.
Carting setts, Mr. John Waldie.
Teak, J. Potter & Co., Ltd.
Teak and cherry, Messrs. Wylie, Stewart & Marshall.
Brush gear, controller insulation, gear cases, British Thomson-Houston Co.
Coal conveyor wheels, Mirrlees, Watson & Co.

**Halifax.**—The Electricity Committee has accepted the following tenders:—

Callender's Cable & Construction Co., Ltd., for disconnecting boxes, £395.
E. Allen & Co., Ltd., Sheffield, for the supply and erection of two 20-in. belt conveyers for the Electricity Works, for £730.

**Ilford.**—The Sunbeam Lamp Co.'s tender for lamps has been accepted for the next 12 months.

**Islington.**—The Lighting Committee has provisionally accepted the following tenders for annual supplies:—

Meters, the British Thomson-Houston Co., Ltd.
Switches, General Electric Co.
Carbons, Sloan Electrical Co., Ltd.
Incandescent lamps, &c., Messrs. H. G. Mayer & Co.

**Leith.**—Last week the Tramways Committee opened the estimates for the overhead equipment of the tramways and remitted them to a sub-committee with powers.

**Poplar.**—The Council has confirmed the recommendation of its Committee for a marine type boiler as follows:—

| | |
|---|---|
| Stirling Boiler Co., Ltd., Motherwell (accepted) .. | £1,950 |
| Babcock & Wilcox .. .. .. .. .. .. .. | 2,112 |

**Rochdale.**—Messrs. Bruce Peebles & Co., Ltd., have received the order from the Corporation for three 120-KW. motor converters on the Peebles-Bragstad-La Cour patent system.

**Shoreditch.**—The B.C. has accepted the following tenders for annual supplies in connection with the electrical undertaking:—

Cables and Sundries.—Messrs. Johnson & Phillips, Siemens Bros. & Co., Western Electric Co.
Engineers' Stores.—Messrs. Jas. Gibbs & Co., Middleton Bros.

**Stockport.**—The Gas and Electricity Committee has accepted the tender of Messrs. Johnson & Phillips, Old Charlton, for supplying and laying feeder and test cables in connection with the tramway extension.

**Stoke Newington.**—Messrs. Bruce Peebles & Co., Ltd., have received the contract for two 120-KW. motor-driven balancers, each consisting of a 120-KW. Peebles-Bragstad-La Cour motor converter. The order also includes seven 50-KW. transformers, switchgear, &c., for stepping down the 10,000-volt primary current.

**Suez Canal Lighting.**—The General Electric Co., London, have placed an order with Messrs. Peter Brotherhood for an engine to drive one of their dynamos in connection with the above work.

**Sunderland.**—The Corporation Electricity and Lighting Committee has accepted the tender of the Phœnix Dynamo Co., of Bradford, for the supply of four three-phase motor-generators. 20 tenders ranging from £2,784 to £5,420 were received. The tender of the Electrical Co. for a steam alternator has also been accepted.

**Wimbledon.**—The Corporation has accepted the tender of the Cable Accessories Co. for the supply of fuse boxes and cable junction boxes and cable stores for one year. The tender of the same company has also been accepted for the supply of fuse boxes, service boxes, and feeder pillars for one year, by the Swindon Corporation.

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## THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following are the orders for next week:—

Monday, April 10.—"A" Company. Recruits' drill, 6 p.m.; technical instruction, 7 p.m.
Tuesday, April 11.—"B" Company. Recruits' drill, 6 p.m.; technical instruction, 7 p.m. Medical inspection for recruits and Special Service Section, 7 p.m.
Wednesday, April 12.—Submarine mining class, 6—9 p.m. Instruction in "Stoking Steam Engine," by Captain W. Bunn, 6.30 p.m. Examination "C" and "D" Companies for "A" badge, 7 p.m.
Thursday, April 13.—"C" Company. Recruits' drill, 6 p.m; technical instruction, 7 p.m.
Friday, April 13.—"D" Company. Recruits' drill, 6 p.m.; technical instruction, 7 p.m.
Saturday, April 14.—Week-end class.

Wilfrid C. Dumble, Captain R.E.
For O.C.E.E.R.E. (V.)

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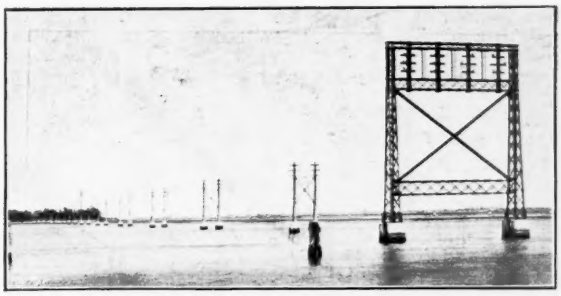
**Municipal Electrical Engineers' Salaries.**—A return recently prepared at St. Pancras showed the salaries of the chief electrical engineers to the Metropolitan municipal undertakings to be as follows:—Battersea, £400; Bermondsey, £350; Fulham, £400, rising £25 annually to £600 (present salary £425); Hackney, £400 to £450 (present salary £450); Hammersmith, £600 to £700 (present salary £600); Hampstead, £750; Islington, £600; Poplar, £400, and £1 per week for use of his own motor-car; Marylebone, £600; St. Pancras, £800; Shoreditch, £250 to £500 (present salary £500); Southwark, £300, rising £25 annually to £400 (present salary £300); Stepney, £350 to £600 (present salary £525); Woolwich, £500.

# THE 36,000-VOLT HYDRO-ELECTRIC INSTALLATION OF THE CELLINA (ITALY).

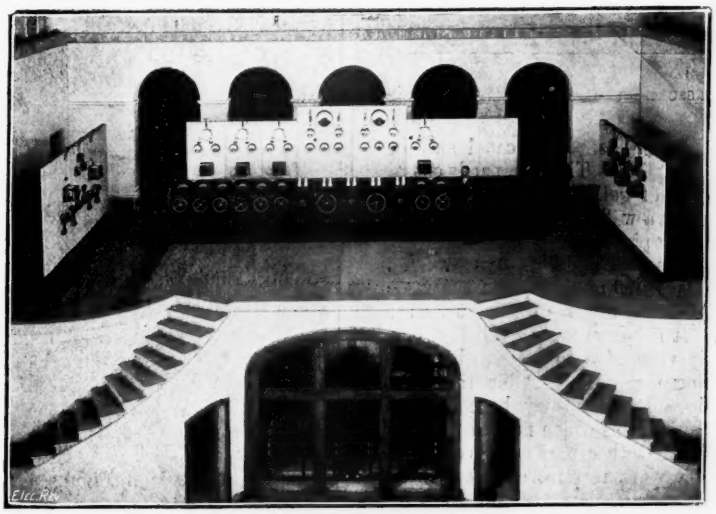
By ENRICO BIGNAMI.

In every country where coal is scarce and water power plentiful, the necessity of utilising to the fullest extent the natural resources of its water-falls for the development of electrical energy is manifest. Especially is this the case in Northern Italy, which is richly endowed with water power, and has thereby been enabled to carry on numerous profitable industries. Several large installations have been erected during recent years, such as those using the water-power of the Aniene at Tivoli, that of the Adda at Paderno and Morbegno, that of the Ticino at Vizzola and Turbigo, and others, and the finishing touch has now been put to a first installation on the Cellina to supply electrical energy in the district of Venice.*



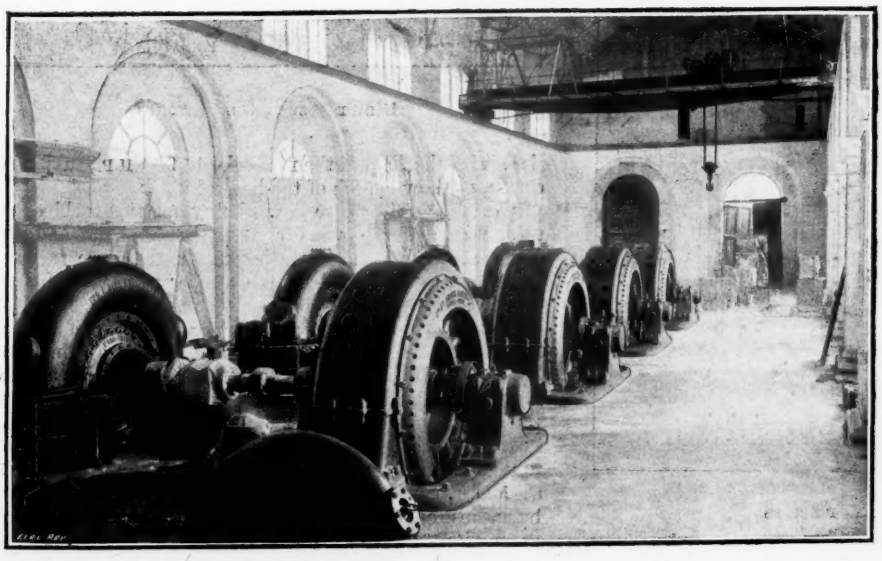
36,000-volt Line Across the Lagoon.

The Cellina is a river which starts from the Claut at an altitude of 2,700 m. in the Carnic Alps, and the watercourse of which of 453 km., on account of its special geological conditions, can deliver, even with the lowest water-level, about 30,000 litres per second.



Main Switchboard.

The works already constructed have been planned so as to take advantage as far as possible of the local formation, which is of an exceptionally favourable character. The work of construction was long and difficult, as there was not even a pathway up the side of the mountain, which, up to the period in question, had been inaccessible; and one can safely say that this is at present the installation which has cost more money and labour than any other in Italy, and even the lives of several workmen.

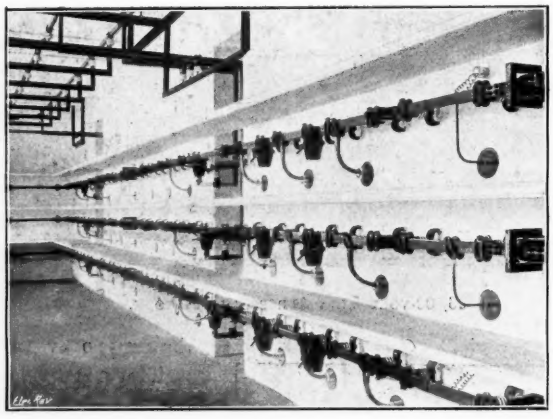


Interior of the Generating Station.

At the intake a dam was constructed at the narrowest part, where solid rock gave strong support. This dam, which is 14 m. high up to the level of the water, has a total length of 32·68 m. At the top the width is 4 m., and it remains so down to 3·10 m.; then the wall, for a depth of 5 m., is curved outward, and is connected with an inclined plane at an angle of 38½° with the horizontal. At the level corresponding to the normal level of the river, the width is 16 m. This dam answers a double purpose: first to raise the water level at the intake, and also by means of an elevation of 3·50 m. above the normal level to create a reservoir of about 300,000 cb. metres for periods of very low water. For feeding the

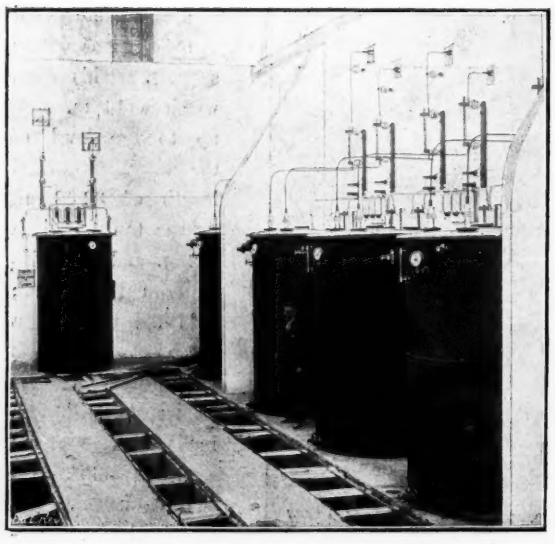
* A second installation already planned will be able to supply a power equal to that of the first.

canal the headworks are divided into two parts. On the right, adjoining the intake, is a weir of a length of 11·60 m. On the left are cut four openings of 3·17 m. each, with the sill 3·50 m. below the level of the weir, to act as overflows when the water is too plentiful. Four large sluices regulate the overflow, and are operated mechanically by electric motors fixed on the bridge which crosses the whole construction. The intake proper is formed by two rectangular mouths 2 m. wide



High-pressure Bus-Bars.

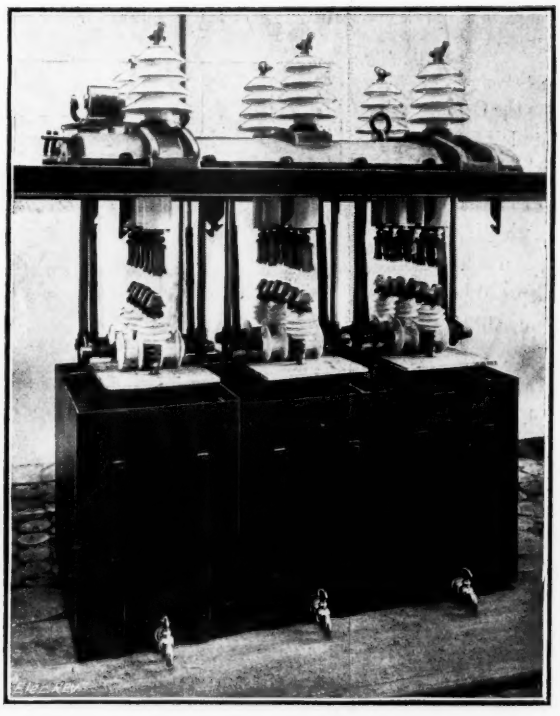
and 3 m. high, adjustable by sluices. The canal may be considered as divided into two parts. The first, partly cut in the rock, supported by a series of walls, arches and galleries, completed on the river side by a wall with an external slope and cemented inside, is a unique piece of work from the intake to the opening of the large tunnel, and is 4,328 m. long. The great tunnel, which is 1,073 m. long, has the same section (4 m. × 2·70 m.) and the same gradient as the canal (0·60 m. per km.). It is cut entirely in chalky rock, stratified, and consequently permeable to water, which was very often met with during the work. After the great tunnel comes the outside branch, which may be considered as the second part of the canal, but which is not so regular in section and gradient as the other part, on account of different works which, for various reasons, are here inter-



Step-up Transformers.

posed. This, like the first part, is cut half way on the side of the mountain, but under easier conditions than the former, and is also supported by an outside wall and cemented inside. This branch leads to a small lake of an area of about 2,400 sq. metres, the object of which is to allow matter in suspension to settle down before the water reaches the turbines. We have now reached the spot where the water is divided between the different generators. There are six large penstocks for the main machines, and a seventh which is divided into two for the small exciter turbines, and there are also two filtering chambers.

Close to the small village of Malnisio is the main machinery building, very spacious and of handsome design. It consists of a central part with two projecting wings and an annex on the west side. The east part contains a workshop for repairs, the warehouse, the offices and living rooms for the engineers and workpeople. The central part is occupied entirely by the main machinery room. In the west part, in a room opening off the turbine room, are the switchboard, switches and lightning arresters, and in the annex are the step-up transformers. Except in this annex, the whole of the building is three storeys high, but the central room occupies the whole height of the building. As the turbines discharge water at a level of 281 m., and the level in the dam is 339·64, the difference of level or head of water is 58·64 m. With a discharge of 20 cubic metres per second representing the minimum of power, there is available 15,600 H.P., and at the time of greatest consump-



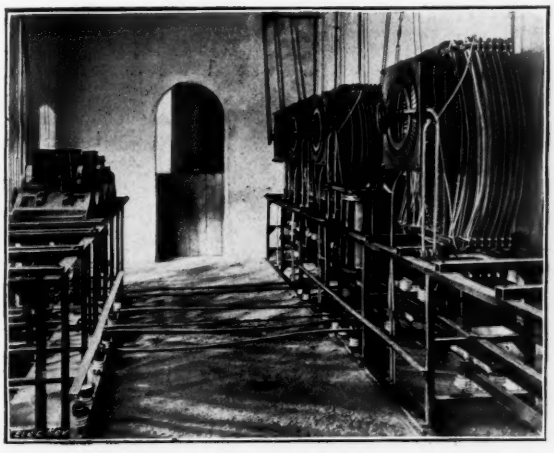
High-pressure Oil Switches.

tion, with the help of the reservoir, 18,900 H.P., subject, of course, to the variation of the head of water.

To utilise this power, inward flow reaction turbines are used with a single wheel and horizontal shaft, and two lateral discharges, one on each side for the large turbines, and a single discharge for the smaller ones used for the exciters; they were manufactured by Messrs. Riva & Monneret, of Milan. The large ones are connected each with its own independent tube. For the present only four are installed, but eventually there will be six of them, one being a spare. Each turbine will take 4,500 litres of water per second, and will develop on the shaft 2,600 H.P., at 315 r.p.m. The turbines for the exciters, smaller but similar in construction to the others, are three in number, and each develops 200 H.P. at 500 r.p.m. The large turbines are connected direct by means of rigid couplings to three-phase alternators of corresponding power, manufactured by Messrs. Brown, Boveri & Co., of Baden (Switzerland), who have supplied the whole of the electrical plant.

These alternators are of the usual type, with fixed armature and rotating field. The magnet wheel, which is a solid piece of steel, carries 16 alternate poles, with the usual winding and polar extension pieces screwed on. The armature core is provided with four closed slots for each coil. The exciting

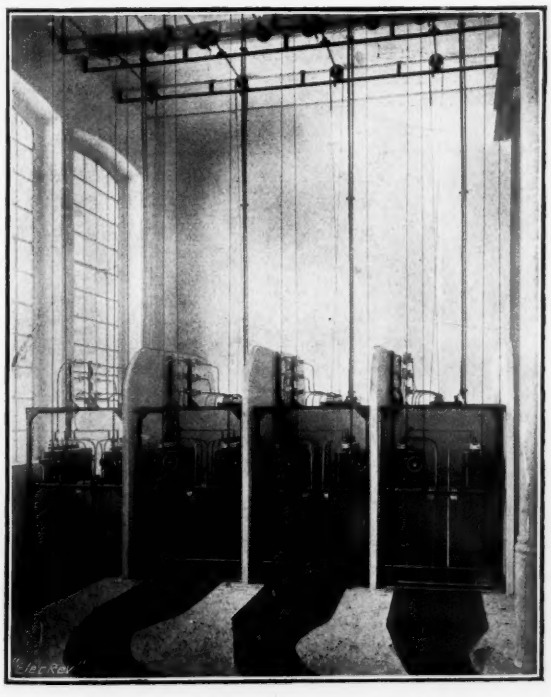
current can be so adjusted so as to gradually vary the voltage at the terminals from 3,600 to 4,800 volts. The commercial efficiency at full inductive load is 95 per cent. The fall of potential between no load and full load, with the usual speed and exciting current, is 5 per cent. of the normal voltage with non-inductive load, and 16 per cent. of the normal voltage with inductive load. Increase of temperature for continuous running, 40° C. in the iron and 45° C. in the copper. Overload allowable for three hours, 25 per cent. The insulation between the windings and the frame was



Alternator Field Rheostats.

tested at 7,000 volts. The alternator is very strongly built, and rests on a cast-iron base which carries the two pedestals. These are of ample dimensions, with swivel bearings and lubricating rings, and means to cool the oil when necessary by running water.

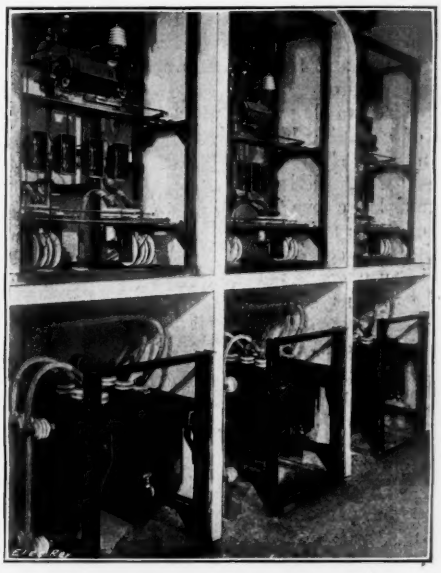
The direct current for exciting the fields of the alternators is provided by dynamos driven by the three small turbines.



Switchgear in the Sub-Station at Venice.

The exciters, directly-coupled by means of rigid couplings to their respective turbines, work at 500 r.p.m., and take 200 H.P. each, generating current at 200 volts. They are shunt wound, with six poles and drum armature, and wide commutator with carbon brushes. The commercial efficiency of the exciters at full load is 93 per cent.

For the step-up transformers the single-phase type has been preferred to the three-phase type, as is customary in the case of large units to limit as much as possible the damage and the cost of repairs in case of accident, and also in view of the advantage of getting higher voltage when



Instrument Transformers and Generator Switches.

necessary by altering the connections from the mesh to the star system.

The power of the transformers has been determined by the capacity of the line they have to feed. As, when the installation is completed, the line will consist of four groups of three conductors, and will have to carry 12,000 KW., each transformer has been designed for a capacity of 1,000 KW., so that each group of three transformers will have to feed a group of three wires. In normal conditions each group of transformers will be connected with a given group of wires, without any connection in parallel on the high-tension side with the other groups, so that in case of a

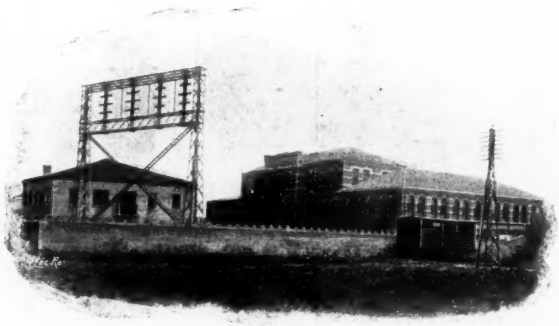
High-Pressure Bus-Bars in Sub-Station.

lightning discharge on the line, only the transformers connected with that particular line will be affected.

When the installation is completed, the working transformers will be 12 in number, and a fifth group of three transformers will be held in reserve, ready to take the place of any of the other groups.

The transformers are made with three vertical cores, with alternate windings round the central one. Their ratio is 7·5 to 1, so that the secondary voltage will be 30,000 volts for a primary voltage of 4,000 volts, and will go up to 36,000 volts for the maximum primary voltage of 4,800 volts. The commercial efficiency of the transformers has been guaranteed at 98 per cent. with power-factor unity. The insulation between the windings and the frame has been tested at 7,000 and 45,000 volts respectively.

The alternators are connected separately to a system of collecting bus-bars in the shape of a closed ring, divided into multiple sections by means of knife switches. The ring of collecting bars is in turn connected with the various groups of transformers, so that it may be considered as divided into two parts; in one the energy comes in, and in the other it goes out, and between the two are placed the integrating wattmeters.



Exterior of the Sub-station at Venice.

The groups of working transformers (two at present, and four when the plant is complete) are connected direct to the lines through lightning arresters, while the spare group is connected to a system of auxiliary bars. These can be used also to put the transformers in parallel on the high tension side, if required. The switches all work in oil; those for medium voltage (4,000 to 4,800 volts) are double-break switches, enclosed in a box; those for very high tension (30,000 to 36,000 volts) are with sextuple break, enclosed in three separate boxes full of oil, one for each phase. All the switches are worked from a distance by means of levers, and can be opened or closed by hand by the switchboard attendant. However, automatic circuit-breakers open the circuit directly the current going through them reaches a pre-arranged limit.

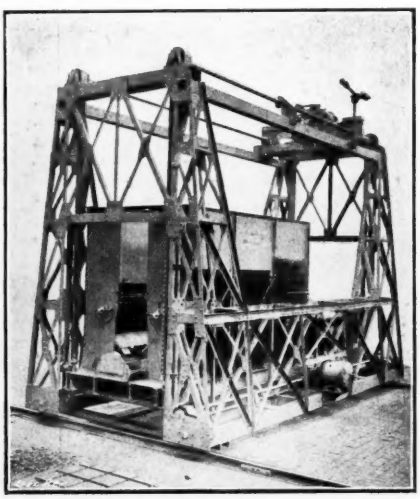
Immediately next to the out-going line are the lightning arresters, of the Wurtz type, with four self-induction coils and with four ways to earth by means of the usual series of non-arcing metal cylinders. But before reaching the Wurtz arresters, any discharge could find its way to earth through a double-horn lightning arrester, and also through a Gola arrester.

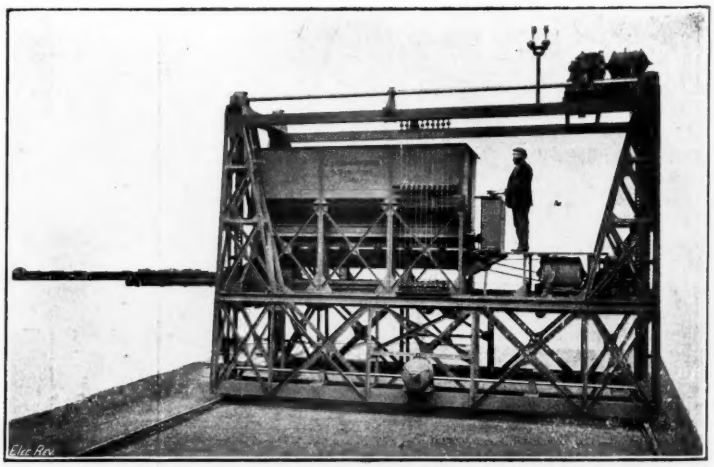
As explained before, the large and small turbines, the alternators and the exciters are in the central room. Below, in large tunnels, are the conduits for the 4,000-volt circuits and the 200-volt circuits for the exciters. These conduits kept well apart, go to one end of the building, and passing to the floor above reach a place under the platform of the switchboard, of which we give a view on p. 571. The board is divided into two distinct parts, one for the direct current with switches, collecting bars and rheostats for the field circuit of the alternators, all worked from the upper platform, and the other for the 4,000-volt three-phase current, where for each alternator there is a masonry partition divided into two parts, the lower one for the automatic switch worked from the upper platform, and the upper one for the measuring transformers for the instruments on the board (see p. 573). At the same spot are found in similar partitions the automatic switches and the measuring transformers for the circuits connecting the collecting bars and the transformers.

The next room, situated on the same floor, is exclusively used for the rings of collecting bars, which are fitted up along the walls and the ceiling and separated by slabs of reinforced concrete.

The conductors connecting the rings with the transformers, after going to the switches in the next room, go down to the lower floor of the tunnels, and, grouped three together, go through a passage round the room where the transformers are in the annex next to the main building. In a similar passage, above the previous one, are the 36,000-volt conductors, which reach the level of the platform of the switchboard close to the high-tension switches, which control the spare transformers. There is room for 13 36,000-volt switches (four of which are automatic) which will be necessary when the installation is complete.

The whole complicated installation is worked and controlled from the platform of the switchboard, which is at one end of the room, at a height sufficient to afford a good view all round. On this platform there is a central board, a table for working the switches, and two lateral boards. The central board carries the instruments in connection with the alternators (ammeters, voltmeters, wattmeters and relays for the automatic switches) and the instruments between the two halves of the bus-bars (ammeters and integrating wattmeters). The working table carries the small hand wheels to work the switches and the rheostats for the field circuit,





Views of the Oerlikon-Bertrand Retort-charging Machine (see p. 575).

the ammeters and exciting switches, the voltmeters and the lamps for phase-indicators.

For the present there are seven main switches, two of which are automatic. After going through these and the transformers for the ammeters, the conductors go to the floor above, where are located the six rows of lightning arresters, and go out overhead by a double row of poles to Venice. The sub-station in that city is already quite finished, and is shown in some our illustrations.

## NEW ELECTRICAL MACHINE FOR CHARGING GAS RETORTS.

In spite of the efforts which have been made to devise a satisfactory machine for charging and discharging gas retorts, the difficulty has hitherto remained that in most cases one machine is required for charging and a different one for discharging. To overcome this inconvenience the apparatus illustrated on p. 574 has been constructed to fulfil both functions at once. The charging implement consists of a ladle which, during its entry into the retort, discharges the coke, and, in its withdrawal, lets fall into the retort the fresh charge of coal. The essential feature of the Oerlikon-Bertrand patent machine is to make the ladle in two distinct parts, which are movable with respect to one another. The machine was made at the Oerlikon Co.'s works, and has been installed at a gas works in Lille, where it serves a battery of five furnaces with 11 retorts each, 3·5 m. in length and arranged in four banks. Thus the machine has to deal with a range of 15 retorts at each operation; the whole process of charging, discharging, and moving from one retort to another occupies a period of 25 to 27 min. for the row of 15. Each charge consists of about 170 kg. of coal (a quantity which can be varied to suit requirements). The various motions are performed at the following speeds:—Charging and discharging, 10 m. per minute; rising, 2 m.; and traversing, 20 m. per minute. The weight of the ladle is from 160 to 190 kg., and the coal bunkers contain 3,000 kg. Each motion is actuated by a separate motor.

The first movement of the ladle pushes the coke out of the other end of the retort, which is of the type with both ends open. The shield on the end of the ladle is hinged, so that it can be withdrawn without interfering with the charge. The ladle is filled from two bunkers carried on the machine.

The motor which controls the ladle drives by wormgear and pinions either a chain attached to the bottom of the ladle, or a drum which winds up a cable attached to the frame; when the mechanism has once been started to insert or withdraw the ladle, it continues in operation until the process is completed, when it automatically stops. When the ladle is right home in the retort, the frame is locked; the bottom of the ladle is then withdrawn, leaving the coal which it contained in the retort; at the end of its travel the bottom unlocks the frame, and the latter is then automatically drawn out in turn. The complete operation occupies 60 seconds. The ladle is refilled by valves in the bottom of the bunkers.

For the vertical movement, the whole of the charging mechanism, platform and bunkers are suspended from four chains, which are driven through sprocket wheels by a motor. When lowering the gear, the motor is caused to generate electricity to control the speed, and a brake interconnected with the electrical circuits is provided, by means of which very accurate adjustments can be made to suit the positions of the retorts. The traversing gear is of ordinary construction.

All the motors drive through worm gear, which is a speciality of the Oerlikon Works. The controllers of the various motions are brought together on the driver's platform in a single casing, and are of stout construction.

The machine is obviously suitable for use only where the retorts are open at both ends, but certain advantages are claimed for this construction.

## FORTHCOMING EVENTS.

**To-day's Arrangements.**—At 7 p.m. I.E.E. (Manchester Students). Annual general meeting at the Salford Royal Technical Institute. "Electric Cranes," by Mr. Jennison.
At 9 p.m. Royal Institution. "American Industry," by Mr. Alfred Moseley, C.M.G.

**Saturday, April 8th.**—At 2 p.m. North of England Institute of Mining and Mechanical Engineers. Meeting.
At 7.30 p.m. Birmingham and District Electric Club. "Lightning Conductors," by Mr. W. H. Whitehouse.

**Monday, April 10th.**—At 8 p.m. Institution of Civil Engineers. Special Meeting. The thirteenth "James Forrest" lecture, by Col. R. Crompton, C.B., on "Unsolved Problems in Electrical Engineering."
I.M.E. (Graduates). "Commercial Vehicles Propelled by Internal Combustion Engines."
At 8 p.m. I.C.E. 13th "James Forrest" lecture by Col. R. E. B. Crompton on "Unsolved Problems in Electrical Engineering."

**Tuesday, April 11th.**—At 7.30 p.m. I.E.E. (Manchester). Annual General Meeting. "Labour-Saving Formulæ," by Mr. Julius Frith.
At 8 p.m. I.E.E. (Glasgow). Reply to discussion on "Earthing," by Mr. W. W. Lackie. "Fittings," by Mr. Harold Watson.

**Wednesday, April 12th.**—At 7.30 p.m. I.E.E. (Birmingham). "The Eddy Current Brake for Motor Testing," by Messrs. D. K. Morris and G. A. Lister.
At 7.30 p.m. Association of Engineers-in-Charge. "Lubricating Oils," by Messrs. J. H. Coste and E. T. Selbourn.
At 7.30 p.m. I.E.E. (students). "Some Notes on the Measurement of Resistance, by Mr. A. Cunnington.

**Thursday, April 13th.**—At 8 p.m. I.E.E. "The Alternating Series Motor," by Mr. F. Creedy. Address to the Joint Meeting at St. Louis, by Mr. B. J. Arnold, A.I.E.E., to be discussed.
Leeds Association of Engineers. Annual Meeting.
I.M.E. Anniversary Dinner at the Hotel Cecil.

**Friday, April 14th.**—At 7.30 p.m. North East Coast Institution of Engineers and Shipbuilders. "The Influence of Oil on the Ultimate Strength of Boiler Furnaces," by Mr. D. B. Morison.
At 8 p.m. Physical Society. "The Determination of the Moment of Inertia of the Magnets used in the Measurement of the Horizontal Component of the Earth's Field," and "Exhibition of a Series of Lecture Experiments, illustrating the Properties of the Gaseous Ions produced by Radium and other Sources," by Dr. W. Watson.
At 8 p.m. I.M.E. Presidential Address by Mr. Edward P. Martin "Steam Engine Research Report," discussion to be concluded, and Prof. Capper will reply.
At 9 p.m. Royal Institution. "The Law of Pressure of Gases below Atmosphere," by Lord Rayleigh.

**Saturday, April 15th.**—At 10.15 a.m. (At gates of works.) I.E.E. (Manchester Students). Visit to the Peel Works, Salford, of the General Electric Co., Ltd.

## NOTES.

**The Manchester Corporation Electric Main Case.**—Sir Thos. Dewar asked the Secretary to the Board of Trade, the other day, whether his attention had been called to a recent action against the Corporation of Manchester in which the plaintiffs succeeded in recovering damages for losses sustained through a fire caused by an explosion in one of the Corporation's electrical mains; and, seeing that the plaintiffs based their claim on the ground that the linking-up system laid down in the streets of Manchester caused a difficulty in localising leakage and constituted a public danger, asked whether this system was generally adopted in London, and whether any improved system had received the consideration of the Board of Trade. Mr. Bonar Law, in reply, said the attention of the Board of Trade had been called to the action. An improved system in which the mains were separated into sections connected by suitable fuses, and whereby the difficulty in localising leakage and consequent risk were much reduced, had received the consideration of the Board of Trade, and had been adopted in all undertakings established during the last two years in London and elsewhere. He also understood that the improved system had been applied voluntarily to many existing undertakings in London.

**London County Council.**—At the meeting on 28th ult., the Finance Committee reported that the balance of the tramway renewals reserve fund amounted to £31,570, of which £25,032 was invested in the purchase of £26,010 of 3 per cent. London County Consolidated Stock. At the suggestion of the Committee, it was decided to invest a further sum of £6,500 in a similar manner.

It was resolved to grant a loan of £7,306 to the Battersea Borough Council for electric lighting mains, and to advance £5,370 to the St. Pancras Council for works and meters.

The Parliamentary Committee presented a report in reference to the recent conference, which was mentioned in a recent issue of the Review, of local authorities which adopted a resolution that the electricity supply Bills before Parliament should be opposed on preamble. The conference was adjourned until the House of Lords Committee on the Bills had given a decision. In the meantime, the Parliamentary Committee stated that notes of the proceedings at the conference had been printed, and copies would be supplied by the Clerk of the Council to members who desired to have them.

The Highways Committee reported having had under consideration the question of the effect upon the tramway work of the omission, among other clauses, from the London Building Acts (Amendment) Bill of the present session of those relating to the cubical extent of buildings and the widening of thoroughfares on the payment of compensation. The former question was of great importance in regard to the erection of buildings for dealing with the operation of a large electric tramway system, while the other clauses would have been of the utmost use in enabling the Council to develop more rapidly the locomotion system in London. It was

hoped that the proposals would be again put forward in the session of 1906, and the Improvements Committee concurred in this expression of opinion. The Highways Committee asked the Council to sanction an expenditure of £150 to enable the chief tramway officer to pay a visit to the United States in order to inspect the arrangements in operation for dealing with through services and the methods of conduit cleaning in New York.

The Council postponed for a week the consideration of a report recommending an expenditure of £351,900 for the construction on the conduit system of authorised tramways in Defoe Road, Garratt Lane, South Street, Red Lion Street and York Road, and for the reconstruction on the same system of the lines from North Street, Wandsworth, along York Road, Battersea Park Road, Nine Elms Lane and Albert Embankment to Westminster Bridge and along Lambeth Road to St. George's Circus, and in addition the tramways from Clapham Junction along Falcon Road to York Road. In the course of a report on the subject the Finance Committee state:—

"Some widenings, estimated at £77,650 net, of which it is assumed that the tramways account will bear one-third, are considered desirable at two or three points on the part of the South London lines included in the scheme, but it is not proposed to delay the reconstruction for these. The estimate now submitted does not include the cost of buildings for car-shed and sub-stations, and estimates for these will be submitted when ready. Their cost is estimated approximately at £57,375. They will not, however, be used exclusively for the lines in question. The Highways Committee recommend the adoption of the underground conduit system of electrical traction, and the estimated results of working, including in the capital charges a proper proportion of the cost of car-shed and sub-stations, show an annual deficiency of £6,138, decreasing by about £667 a year as the debt is paid off. The opening of these lines would no doubt lead also to increased traffic on existing lines, particularly the Tooting lines, but no figures can be given that could be at all relied upon. In arriving at the estimated results of the working of these lines, provision is made for payment of interest and sinking fund charges, £4,000 a year, on a proportion of the cost of acquiring the tramways of the South London Co., also £4,618 a year in respect of the cost of street widenings. Provision is also included of £8,486 a year in respect of renewals, calculated at 1d. a car-mile estimated to be run.

"In considering these estimated financial results, the results now being obtained by horse traction from the section of the South London lines included in the present scheme should be taken into account, and we are informed that these lines are now being worked at a loss. We are unable to say what the loss is on the part of the system which it is now proposed to reconstruct, but we are informed that on the South London system as a whole the deficiency on working, before paying interest and sinking fund charges in the year 1904-5, has been about £3,500.

"The reconstruction of the Battersea Park Road line may prejudicially affect the Wandsworth Road line, which runs roughly parallel to, and a short distance to the south of, the Battersea Park Road line. The Wandsworth Road line would still have to be worked as a horse line, and the reconstruction of it is rendered difficult by the fact that the line is to a great extent single line only, and the streets need a good deal of widening to enable a satisfactory electric line to be laid.

"The Council will note the fact that although this reconstruction involves a large outlay of money, it is not expected to result in any surplus after the debt charges have been met, at any rate, for some years to come."

The proposal of the Highways Committee was discussed for an hour and a half at the meeting on the 4th inst. An amendment to refer the recommendation back to the Committee was defeated on a division by 87 votes to 15, and the Council then sanctioned the execution of the scheme.

The Improvements Committee reported that the Underground Electric Railways Co. of London had now agreed to terms, whereby the company should be permitted to proceed at once with the construction of that portion of the lines authorised by the Great Northern and Strand Railway Act and the Brompton and Piccadilly Circus Railway Act, as would be built under the new street known as Kingsway.

At a meeting of the Council on Tuesday last, it was decided to lend £11,083 to the Hackney Borough Council for extensions of the electricity undertaking and for street lighting.

The General Purposes Committee reported that the Fire Brigade Committee had drawn attention to the question of the terms of payment in contracts for electric light installations at fire stations. It appeared that for several years past payment had been made at the rate of 80 per cent. of the contract price on the completion of the work, and the balance of 20 per cent. at the expiration of the period of maintenance, but in order to comply with the Standing Order relating to retention moneys in contracts not exceeding £100,000, the balance payable at the end of the period of maintenance should be only 5 per cent. of the contract sum. The Fire Brigade Committee were advised that it was very desirable, as the amount involved in such contracts was very small, that the terms of payment should be those in force hitherto—namely, 80 per cent. of the contract price (less extras) on completion of the work, and the balance at the termination of the maintenance period. The General Purposes Committee concurred in the suggestion, but they thought it undesirable to limit the application of the standing order to installations at fire stations. They had therefore prepared an amendment of the fourth paragraph of the standing order so as to render it applicable to electric lighting installations generally. On the recommendation of the Committee, the Council resolved that payments should be made in the future as follows—80 per cent. of the contract price (less extras) on the completion of the work; the balance after the expiration of the prescribed period of maintenance.

The Council voted an expenditure of £150 for travelling and other out-of-pocket expenses to be incurred by the chief officer of tramways in inspecting the electric tramways in operation in New York and other American cities.

The Housing Committee stated that by arrangement with the County of London Electric Supply Co., the 260 cottages on Section A of the Totterdown Fields estate were supplied with electric light on the automatic prepayment system at the rate of 1d. for six hours' 8-c.p. light. As the company were willing to enter into a similar arrangement for lighting the cottages on Section B, the Committee proposed that the necessary facilities should be afforded for the work to be carried out.

**South African Notes.**—Swaziland.—In connection with the opening up of the Mbabane tin mines, a new dredger is to be provided which will be worked by electrical power derived from fixed power plants at convenient spots on the Mbabane River.

Before the Swaziland Concessions Commission, sitting at Mbabane, Mr. Nath. H. Cohen, for the registered owners, appeared in support of their claim for expropriation of the monopoly under Clause 12 of the Swaziland Administrative Proclamation, 1904. This was a concession for the sole and exclusive right of using electricity as a motive power. It had previously included the rights to a monopoly over telegraphs and telephones, but this part of the concession had been acquired in 1898 by the Transvaal Government. After a lengthy argument, Mr. Cohen referred to the value of the concession, pointing out that the telegraph rights had been sold for £7,000, and said that Swaziland, being a young country, was full of possibilities for electric motive power and electric light. The hearing terminated without any definite sum being fixed as the amount claimed for compensation.

**Ben Trovato.**—From the *Wisconsin Engineer* of March last, in an article on "Patent Law," we cull the following jokes. The first is credited to Mr. Stephen D. Field. One of his inventions was a neutral relay in which the tongue was arranged so as to make and break contacts upon two sides, as it was attracted to one side or the other by the electromagnets between which the armature was placed. Mr. Field, in putting his application for a patent into the Patent Office, christened it an "Expert Relay." This appellation rather puzzled the examiner, and he wrote asking why this relay was given this peculiar name. Mr. Field replied "I call my relay an Expert Relay because it has a tongue which is adapted to lie on either side with equal facility, according to influence brought to bear upon it." The second related to an argument before the Court in an important case, in which counsel for the defendant made a fierce attack upon experts and inventors, beginning as far back as Galileo and condemning the whole tribe as tricksters and charlatans. When counsel for complainant replied, he referred to the wholesale massacre of scientific reputations which had been accomplished by his adversary, saying that, figuratively, the Court-room was knee-deep in the blood of slaughtered reputations. He knew, he said, of only one case in recorded history where there had been such desperate havoc and destruction, and that was in the case of the slaughter of the Philistines, which, strange to say, was accomplished by the same weapon.

**Railway Monopoly on Land and Sea.**—We have received a lengthy circular letter on this subject from Mr. J. B. Pope, chairman of the Denaby and Cadeby Main Collieries, which, unfortunately, the limitations of our space prevent us from inserting *in extenso*. Mr. Pope points out the evils inseparable from railway monopolies on land, and protests with vigour against the granting of powers by Parliament, which enable railway companies to run steamships between British and Continental ports, thus setting up competition of the most ruinous character with existing shipping companies. The first step in this direction was taken by the Lancashire and Yorkshire Co. last year, and now the North-Eastern Co. is following the same path. Mr. Pope maintains that the inevitable result of the extension of such privileges will be the extinction of the legimate enterprise of the shipping companies, and the downfall of British trade.

**Inventors and Patent Agents.**—We have received an interesting letter on the subject of Patent Agents, for which we cannot spare space, but we give the following extracts therefrom:—

"A Bill has just been introduced into Parliament which, if passed, will deprive inventors of their right to employ as agents any persons who, from their special knowledge in engineering, electricity, chemistry or other sciences, are able to afford them the assistance they may require in preparing their applications for patents.

"The next step will undoubtedly be to prevent inventors communicating with the Patent Office at all, except through registered agents, and on the precise terms those agents would then be in a position to dictate to the hapless individuals thus placed in their clutches.

"In reference to the judgement of the Chartered Institute of Patent Agents as to who ought, and who ought not, to be allowed to practice, I find in a Government Report that out of six names which they brought to the notice of the Board of Trade as proper to be removed from the Register, only one was so removed.

"Further, the Board of Trade actually allowed persons to be registered, notwithstanding the decision of the Institute that those persons were not fit to go on the Register.

"Of the 254 registered agents, 160 have not passed a qualifying examination, and of this 160 as many as 101, or over 63 per cent.,

are Chartered Agents, who apparently look on themselves as the cream of the profession.

"It appears also that Chartered Agents are recommended not to charge less than five guineas for provisional protection. Inventors will therefore know what to expect if the whole of the business falls into the hands of Chartered Patent Agents.

"Referring again to the above-mentioned Government Report, I find a Chartered Patent Agent saying that the state of things was worse under registration than it was five years earlier, when no one was registered, and 'the profession was only too rightly looked on by some as a den of thieves.'

"After this, I was not surprised to find the following words in the Report of the Parliamentary Committee:—

"'The Committee concur in the opinion expressed by the Committees of 1865 and 1866, and consider that, while it is desirable that there should be a roll of duly qualified agents practising at the Patent Office, there should be no regulation which would prevent solicitors, or other professional men, from transacting business at the Patent Office, or compel the inventor to employ any particular class of agent, or any agent at all.'

"Such being the position, it is surely time inventors organised themselves, and I am prepared to receive the names of all inventors who are willing to join a National Association to look after their general interests, and to resist legislation tending to deprive them of any of their rights."

The letter is signed by Mr. C. Crossley, of 9, Zenobia Mansions, W. There is no doubt that the title of "Patent Agent" has often been arrogated to themselves by incompetent and unscrupulous persons, and we regard the right of direct access to the Patent Office as of immense importance to the inventor of small means.

**The Telephone Exchange Fire.**—The City of London Coroner, Dr. F. J. Waldo, held an inquiry on Tuesday at the City mortuary, under the City Fires Inquest Act, with reference to the fires which occurred simultaneously at the premises of the National Telephone Co. in Oxford Court, Cannon Street, and Mansion House Chambers, Queen Victoria Street. From the *Times* we gather that the Coroner, in opening the proceedings, said that the building known as Mansion House Chambers was a huge one, and contained some 550 offices, so he was informed. It was, in fact, quite a rabbit-warren. In the upper floors of this building, which was four storeys high, the Telephone Co. had their Bank exchange. The fire, which broke out at two o'clock on the morning of February 28th, destroyed two little wooden structures on the roof, which were known as the test room. In the switch room immediately behind the test room some 90 women telephone operators and 10 male exchange inspectors were engaged during the day. At night four male operators only were engaged there. The fire at the Oxford Court premises of the company broke out in the telephone distributing room on the topmost floor, where reside the housekeeper and his wife. The distributing room was closed at the time, and was seldom used except for the purpose of inspection or repairs. The origin of the fire had been traced to a cause the location of which lay outside his jurisdiction. It appeared from what he had been informed that some electrical work was in the course of execution on the inner circle of the District Railway which rendered necessary some alterations in the telephone wires in the tunnels. Some tests were being conducted on the railway early on the morning in question, and the conductor rails were charged. One of the telephone cables came into contact with the live rail, an arc occurred, the lead sheathing was melted off the cable, and the wires came into contact with the rail. The telephone wires, used to carrying only a voltage of 22 or 24 volts, received the current at 600 volts from the rail. That current was carried to the test room of the Bank Exchange and the cable room, and caused fires at both places. He (the coroner) investigated the case, and came to the conclusion that no public inquiry was needed, but he hoped that an inquiry would be made by one of the electrical inspectors of the Board of Trade. Within the last week, however, several members of the City Corporation asked him to hold an inquiry. Thereupon he communicated with the Board of Trade, and had received a reply from Lord Salisbury that the fire "did not appear to be a matter in regard to which the Board of Trade had any power to order an inquiry." He had decided, therefore, to hold an inquest.

The jury afterwards spent some time in viewing the site of the fire, and the inquiry was adjourned.

**Appointments Vacant.**—The Yorkshire Electric Power Co. invites applications for junior assistants (£26 first year, £52 for the second); assistant lecturer for Swindon (£150); station superintendent for Belfast (£4).

## OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

**Central Station Engineers.**—Mr. C. M. Shaw, the late electrical engineer at Wakefield, was, on 31st ult., presented by the Mayor, on behalf of himself and the Corporation officials, with a complete set of the works of Charles Dickens, in recognition of the esteem which he has gained during the time he has been with the Corporation. On 17th ult. Mr. Shaw was presented by the whole of the works staff with a marble timepiece, as a souvenir of his three years as chief of the works.

Mr. W. H. Miller, who has for the past eight years held posts at the Belfast Electricity Works, has been finally selected for the approval of the General Purposes Committee of the Wakefield Corporation for the post of first assistant electrical engineer.

Mr. J. Martin Blair, resident electrical engineer at Acton, notifies that his department has now been removed, and he asks that all communications in future should be addressed to him at the Electricity Department, Gothic Villa, Mill Hill Grove, Acton, W.

Mr. A. V. Wardrop, the new electrical engineer of the Elland District Council, has been presented with a handsome clock, suitably inscribed, by his former colleagues under the York Corporation.

Bermondsey Borough Council elected, on Tuesday night, a chief electrical engineer. There were 65 candidates, and of these three were selected by the Lighting Committee to go before the Council, as follows:—Mr. Neville Appelbee, electric lighting and tramway engineer, Ashton-under-Lyne Corporation; Mr. W. E. G. Heenan, borough electrical engineer and tramway manager, Southend-on-Sea; and Mr. John B. Mitchell, borough electrical engineer, Woolwich. The voting on the first round was—Mr. Appelbee, 26; Mr. Heenan, 31; Mr. Mitchell, 6. On the second round the voting was—Mr. Heenan (elected), 25; Mr. Appelbee, 23. Mr. Heenan, M.I.E.E., before he went to Southend, where he has been for the last three years, was chief engineer for eight years, and previously assistant engineer for two years, to the Northampton Electric Light and Power Co.

Mr. S. C. F. Mitchell, of Hampton Wick, recently in the employ of Messrs. Christian & Phipps, has been appointed resident electrician at the Burghill County and City Asylum, near Hereford. There were over 250 applicants who applied in response to the advertisement which appeared in our issue of 10th ult. Unsuccessful candidates are asked to accept this intimation of the result.

**Tramway Officials.**—The Tramways and Electricity Committee of Keighley Corporation has recommended that the management and control of the tramway car-shed, cars, and electrical equipment be placed in the hands of the tramways traffic manager in future.

The Glasgow Tramways Committee of the T.C. has agreed to recommend the Corporation to make the following changes in the staff, consequent on the appointment of Mr. James Dalrymple as general manager, and the resignations of Mr. C. A. King, permanent way engineer, and Mr. Matthew A. Bell, accountant:—Mr. John Ferguson, chief mechanical engineer, to be appointed chief engineer, and, in addition to his duties, to be responsible for the whole of the work formerly carried out by Mr. King; Mr. James N. Wilson, general manager's secretary, to be appointed secretary to the department; Mr. Robert F. Smith, cashier, to be appointed accountant to the department, in room of Mr. Bell, resigned; Mr. William Smeaton, chief purchasing clerk, to be appointed cashier, in room of Mr. Smith; and Mr. A. C. Macdougall, chief storekeeper, to be appointed chief purchasing clerk, in the room of Mr. Smeaton. The Committee also proposes to increase the salaries of the following members of the staff:—Mr. L. Mackinnon, traffic superintendent, from £400 to £550; Mr. John Ferguson, chief engineer, from £400 to £550; Mr. Ernest T. Goslin, electrical engineer, from £350 to £450; Mr. James N. Wilson, secretary, from £225 to £300; Mr. Robert F. Smith, accountant, from £160 to £200; Mr. William Smeaton, cashier, from £155 to £200; Mr. George London, civil engineer, from £156 to £200; and Mr. James Grieson, civil engineer, from £150 to £200. The total annual saving to the Corporation by this arrangement will amount to £886.

Yesterday the Glasgow Corporation granted leave of absence to Mr. Dalrymple, tramways manager, to go to Chicago to assist in municipalising the tramway system of that city.

**General.**—Electrical men have been studying the papers anxiously from day to day this week, to ascertain the course of Lord Kelvin's illness. His Lordship, who underwent a serious operation on Thursday last week, has, we are glad to note from the daily bulletins, made most satisfactory progress. Repeated inquiries have been made by the King and the Prince and Princess of Wales. Lord Kelvin is the object of admiration and affection among multitudes of scientists, engineers and students, in all parts of the world, and the announcement of his illness has naturally excited wide-spread sympathy. All join in the profound hope that Lord Kelvin may be completely restored, and that—his 82 years notwithstanding—he may be spared many years yet to labour in the cause of science.

Mr. Phya Sakdisenie has been appointed Director-General of Posts and Telegraphs in Siam vice Mr. Phra Praisanie.

Mr. R. H. Schofield has been appointed by Messrs. Ferranti, Ltd., to represent them in the southern half of Great Britain.

Mr. H. W. Warde, manager of the Glasgow branch of the General Electric Co., Ltd., has recovered from his accident in the railway collision at Glasgow a few months ago. He has now returned to business after an absence of about six months.

Mr R. B. H. Cragg, A.I.E.E., late of the Central London Railway, has been appointed assistant engineer on the staff of Mr. J. K. Robinson, agent for the American Westinghouse Co., at Iquique, Chili, South America.

Mr. Pierre de Szalay, the Director-General of Posts and Telegraphs, Hungary, has been given the title of Secretary of State by the King as a proof of his high satisfaction. Mr. Szalay was president of the International Telegraph Conference held at Budapest, and has represented his country at others.

Mr. E. H. Tyler, superintendent of the Kolar Gold Fields Electricity Department, has resigned.

Dr. W. G. Rhodes has changed his address to Adelphi Chambers, Brown Street, Manchester.

On leaving Ilford to take up an appointment in the Meter Department of the St. Pancras Borough Council, Mr. J. C. Elvy, super-

intendent of the meter department, was presented by the staff of the Electricity Works with a handsome oak cabinet inkstand suitably engraved.

The Telephone Committee of Brighton T.C. has recommended the engagement of Mr. A. R. Bennett as consulting telephone engineer at a yearly fee of 75 guineas.

**Obituary.**—We deeply regret having to record the death of Mr. Charles Alexander Gebhardi, so long known in connection with submarine telegraphy. He had been engaged in telegraph work for half a century, when he retired in 1903; the last 30 years of his service was in the capacity of manager and secretary of the Direct Spanish Telegraph Co., for whom he attended several meetings of the International Telegraph Conference. Previous to his connection with the Direct Spanish Co., he had been engaged at different times in the service of the Electric and International Telegraph Co., the Atlantic Telegraph Co., and the Submarine Telegraph Co. He was present at the first Atlantic cable-laying operations of 1857 and 1858, and was a member of the old Society of Telegraph Engineers. His death, which took place on 2nd inst. at Crouch Hill, will be sincerely regretted by a very wide circle of telegraph men. He was in his 68th year, so it may be said that he had spent his whole life in telegraphic work. The directors of the Direct Spanish Co, in announcing his resignation after serving "his company with zeal and ability for 30 years," recognised his services by granting a pension of £500 per annum, "to be continued at the pleasure of the board." They will with us regret that he was only spared two years to enjoy his well-earned retirement.

We have also to deplore the death of Mr. John Bailey, which occurred on March 30th, after a comparatively short illness. By the decease of Mr. Bailey we lose another link of connection between the earliest days of submarine telegraphy and the present time. Mr. Bailey was born in London on July 24th, 1830, and was thus, at the time of his death, in his 74th year. At the early age of 14 he obtained a situation in a mercantile office in London, where he worked for about four years, after which he entered the service of the firm of Messrs. S. W. Silver & Co., of Cornhill, where he remained until the year 1857, when he was appointed to the post of resident manager of the works at Silvertown, which were then in an embryonic condition. From that date until his transfer to the headquarter's office in Cannon Street in October, 1900, he remained at Silvertown. During this period of 43 years he saw the rapid developments which have taken place not only in the works but in the surrounding district, and in the growth of the Silvertown Telegraph Factory, which was registered as a public company in March, 1864, under the name of the India-Rubber, Gutta-Percha and Telegraph Works Co. Ltd. The growth of these works was, to a great extent, due to the tireless energy and organising ability which Mr. Bailey possessed in a high degree, and he took a justifiable pride in looking back on the progress of the factory with which he had been so long connected, not only by work, but by actual residence. In the early 60's the neighbourhood in question, which now forms a portion of the densely-populated borough of West Ham, was simply an isolated group of buildings on the marsh land on the bank of the Thames, and Mr. Bailey took an active part in promoting and the carrying on of all local improvements. He was long connected with the 9th (now 4th) Essex Rifle Volunteers, retiring with rank of captain some 25 or 30 years ago. He was a strong member of the Church of England, and being gifted with musical tastes, he took a leading part in the choral society and entertainments of the neighbourhood. In the year 1875 he acted as associate member of the Council of the Institution of Electrical Engineers, which was then known as the Society of Telegraph Engineers, in the progress of which he took a great interest. On his transfer to the headquarter's office, from which he retired in October, 1902, the employés at Silvertown presented him with an address expressing the high esteem and regard in which he was held by them, and accompanied this by a memento of plate. By the retirement and death of Mr. Bailey the Silvertown Co. have lost an able and zealous assistant, who will long be held in memory by all those who were associated with him. His unfailing cheeriness and good nature, which were unaffected by stress of work, together with the intimate knowledge which he possessed of all the details and difficulties which must necessarily arise in connection with a large establishment, made it easy and pleasant to work with him. Mr. Bailey only survived the loss of his wife by a few weeks, and leaves a family of four sons and five daughters, to whom we tender our sincere sympathy in the loss which they have sustained. He was buried at Margate on Saturday, and several of the officials of the India-Rubber, Gutta-Perch, and Telegraph Works Co. attended the funeral.

## NEW COMPANIES REGISTERED.

**Singapore Electric Tramways, Ltd.** (84,088).—This company was registered on March 29th, with a capital of £400,000 in £1 shares, to acquire the business of the Singapore Tramways, Ltd. (incorporated in 1901), to adopt an agreement with the East India Construction Syndicate, Ltd., to construct or acquire, equip, maintain and work (either by electrical, steam, horse, or other power) tramways, railways, and other means of communication in Singapore and other parts of the Straits Settlements or elsewhere, to acquire running powers, rights, or easements over any railway, tramway, or other property, and to carry on the business of generators, accumulators and distributors of electrical energy for heat, light and motive power, electricans, tramway and railway proprietors, carriers of passengers and goods, manufacturers of electrical cables, wires, lines, motors, generators, dynamos, accumulators, transformers, lamps and machinery, &c. The first subscribers (each with one share) are:—R. W. Ashton, 59, Bolton Road, Stratford, clerk; M. H. Clemow, 49, Portland Road, Notting Hill, W., clerk; A. E. Dorney, 9, Chandos Road, Willesden Green, N.W., clerk; A. A. Harvey, 22, Dunlace Road, Clapton, N.E., clerk; A. W. H. Osborne, 52, Hardwick Road, Palmers Green, N., clerk; E. V. Staff, 20, Norcott Road, Stoke Newington, N., clerk; A. E. Thornton, 276, Portland Road, South Norwood, S.E., clerk; and the Singapore Tramways, Ltd. No initial public issue. The number of directors is not to be less than two nor more than nine; the subscribers are to appoint the first; remuneration, £200 each per annum, and £100 extra for the chairman.

**Accessories Manufacturing Co., Ltd.** (84,107).—This company registered on March 31st, with a capital of £10,000 in £1 shares, to carry on the business of electricians, manufacturers of and dealers in electrical accessories, electrical fittings, goods and supplies, electrical, mechanical and lighting engineers, &c., and to adopt an agreement with R. Ball and A. K. Ball. The first subscribers (each with one share) are:—R. Ball, 9 and 10, Wells Street, W., electrician; A. K. Ball, 6, King's Bench Walk, Inner Temple, architect and surveyor; A. J. L. Ball, 37, Carleton Road, N., surveyor; J. D. M. Douglas, 78, Windsor Road, Ilford, traveller; S. H. Isles, 51, Selborne Road, Ilford, cashier: H. E. Watts, 96, Harbut Road, New Wandsworth, S.W., clerk; and W. Field, 202, The Grove, Stratford, clerk. No initial public issue. The number of directors is not to be less than three nor more than five; the first are R. Ball, A. K. Ball and A. J. L. Ball; qualification, 100 shares; remuneration as fixed by the company.

**Wrexham Motor and Electrical Engineering Co., Ltd.** (84,046).—This company was registered on March 27th, with a capital of £5,000 in £1 shares, to acquire from H. Higginson and W. H. Roberts two freehold houses in Chester Street, Wrexham, and three houses, with maltkiln, yard and outbuildings in the rear of the first-mentioned premises, to adopt an agreement between the said vendors of the one part, and G. L. Cathrall and C. Cathrall (for the company) of the other part, and to carry on the business of motor, electrical and mechanical engineers, builders and constructors of motor-cars and motor and other cycles, &c. The first subscribers (each with one share) are:—H. Higginson, Ruabon Road, Wrexham, cycle agent; W. H. Roberts, 44, Hope Street, Wrexham, ironmonger; G. L. Cathrall, 21, Chester Street, Wrexham, electrical engineer; C. Cathrall, 2, Cross Street, Wrexham, electrical engineer; J. T. Williams, 44, Hope Street, Wrexham, ironmonger's assistant; W. Higginson, 104, High Street, Wrexham, leather dresser; and W. Smith, Gate Inn, Rhosnessney, Wem, innkeeper. No initial public issue. Registered without articles of association. The first directors are H. Higginson, W. H. Roberts, G. L. Cathrall, and W. Smith. Registered office, 37 and 38, Chester Street, Wrexham.

**Pharos Light Syndicate, Ltd.** (84,086).—This company was registered on March 29th, with a capital of £1,000 in £1 shares, to acquire and turn to account certain inventions, processes, patents, monopolies, concessions, trade marks and the like relating to the production by atmospheric, electrical or other power, of compressed gas and machinery for compressing coal gas, to grant licences for using such processes in Great Britain, the U.S.A., and elsewhere, to manufacture and deal in electrical, gas and other appliances, meters and fittings, &c. The first subscribers (each with one share) are:—I. Shone, 47, Victoria Street, S.W., civil engineer; E. Ault, 47, Victoria Street, S.W., civil engineer; A. Shone, 47, Victoria Street, S.W., book-keeper; T. E. Stephens, Woodthorpe, Purley, Surrey, drug merchant; T. H. Stephens, Woodthorpe, Purley, Surrey, drug merchant; and C. T. A. Haussen, 319, Lordship Lane, East Dulwich, S.E., civil engineer. No initial public issue. The subscribers are to appoint the first directors.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**London Electric Wire Co., Ltd.** (36,544).—This company's annual return, made up to February 15th, has been filed. 15,807 ordinary and 5,956 preference shares have been taken up out of a nominal capital of £150,000 in 20,000 ordinary and 10,000 preference shares of £5 each. £5 per share has been called up on 8,087 ordinary and 5,956 preference, and £70,215 has been received. 7,720 shares are considered as fully paid. Mortgages and charges: Nil.

**Europe and Azores Telegraph Co., Ltd.** (39,452).—This company's annual return was filed on February 10th, when 18,146 shares had been taken up out of a nominal capital of £200,000 in 20,000 shares of £10 each. £10 per share has been called up on 12,578 shares, resulting in the receipt of £125,780. 5,568 shares are considered as fully paid. Mortgages and charges: Nil.

**Eastern Telegraph Co., Ltd.** (6,338 C).—Issue, on March 8th, of £10,000 debenture stock, being the whole of series created by board resolution of March 8th, 1905. Property charged: The company's undertaking and revenue. Holder: F. R. De Levanté, 141, Hill Street, Peckham, S.E. No trustees. Debenture stock previously issued: £1,887,704.

**Webster Electrical Engineering Co., Ltd.,** Bradford (88,637).—Issue, on March 13th, of £625 first mortgage "A" debentures, part of series created February 28th, 1905, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any) and unpaid calls. Holder: F. W. T. Newboult, Ivy House, Moorhead, Shipley. No trustees. No previous issue of same series.

**Kensington and Knightsbridge Electric Lighting Co., Ltd.** (26,193).—This company's annual return was filed on March 11th, when 21,000 ordinary, 10,000 first preference and 10,000 second preference shares had been taken up out of a nominal capital of £850,000 in 50,000 ordinary, 10,000 first preference and 10,000 second preference shares of £5 each. £5 per share has been called up on 15,968 ordinary, 10,000 first preference and 10,000 second preference shares, resulting in the receipt of £179,840. £25,160 is considered as paid on 5,032 ordinary. Mortgages and charges: £90,000. Debenture stock issued by this company in conjunction with the Notting Hill Electric Lighting Co., Ltd.: £152,500.

**Nernst Electric Light, Ltd.** (60,807).—This company's annual return was filed on March 16th, when 89,590 shares had been taken up out of a nominal capital of £90,000 in £1 shares. £1 per share had been called up on 57,500, and the remainder are considered as fully paid. No mortgages or charges. (Original capital £320,000. Reduced in 1904.)

**Kramos, Ltd.,** electrical engineers, Bath (82,859).—Issue, on February 22nd, of £1,600 debentures, part of series created same date, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: M. Simons, 93, Candleriggs, Glasgow; H. J. Walford, 47, Hamilton Terrace, London; and M. J. Garcia, 55, Warrington Crescent, Maida Vale. No trustees.

**The Holborn and Finsbury Electrical Exhibition.**—We understand that the Holborn and Finsbury Exhibition, which closed on Wednesday after a run of nearly three weeks, has been successful to a degree beyond the best anticipation. In many cases considerable business has been transacted by the exhibitors, and orders taken covering very big amounts. The inquiries, too, from power users and the interest taken generally, lead the County of London Co. to anticipate an immediate augmenting of their already big power operations. A dinner is being organised by the exhibitors in honour of the occasion, and will be held early next week.

## ELECTRICITY SUPPLY ACCOUNTS.

**The London Supply Companies.—II.**

This week we complete the tabulated returns of the London Electricity Supply Companies, of which the first seven were given in a previous issue. We again remind readers that the reports and financial results of these companies have been given at length in our "City Notes."

Of the companies referred to below, the County of London Co. is the most important, and it records a very satisfactory year, the output having increased by 25 per cent., and the gross revenue by some 16 per cent., while working expenditure has been reduced. Included in the equivalent lamp connections are some 8,000 H.P. of motors, of which 2,000 H.P. has been added during the past year.

The South London Electric Supply Corporation record a larger output than the last-named company, due to the temporary traction supply taken by the L.C.C., the effect of the latter load on both working costs and average revenue are very apparent.

| | South London Electric Supply Corporation. | County of London Electric Supply Co. | Notting Hill Electric Lighting Co. | Brompton and Kensington Electricity Supply Co. | Kensington and Knightsbridge Electric Lighting Co. | Chelsea Electricity Supply Co. |
|---|---|---|---|---|---|---|
| Total capital expended ... ... ... | £341,258 | £1,383,593 | £224,267 | £253,987 | £355,144 | £454,854 |
| Total number of units sold ... ... | 9,205,342 | 7,181,309 | 1,645,492 | 2,544,758 | 4,558,176 | 3,212,412 |
| Equiv. 8-C.P. lamps connected ... ... | 107,000 | 647,711 | 132,132 | 169,869 | 303,048 | 210,659 |
| Gross revenue ... ... ... ... | £72,506 | £135,790 | £34,564 | £50,189 | £78,149 | £60,071 |
| Per unit ... ... ... ... ... | 1·89d. | 4·53d. | 5·05d. | 4·73d. | 4·12d. | 4·5d. |
| Gross expenditure ... ... ... ... | £41,158 | £56,913 | £14,718 | £21,919 | £39,217 | £25,008 |
| Per unit ... ... ... ... ... | 1·07d. | 1·90d. | 2·15d. | 2·07d. | 2·07d. | 1·87d. |
| Gross profit ... ... ... ... ... | £31,348 | £78,877 | £19,846 | £28,270 | £38,932 | £35,063 |

The Kensington and Knightsbridge and Notting Hill Companies both record improved costs, the former obtained about two-thirds of its supply in bulk from the joint Wood Lane station, and the latter 1,900,000 units from the same source. The latter works record the excellent figure of 1·12d. per unit, including all working and financial charges.

The Brompton Co. shows a diminution in lamp connections, compared with last year, and owing to reductions in price, the profits show a decrease for the first time in the history of the company.

The returns of the Chelsea Co., which do not call for comment, complete the table.

## CITY NOTES.

### Liverpool District Lighting Co.

Colonel A. H. Holme presided at the annual meeting held at Liverpool on 29th ult. The report was abstracted in the Electrical Review for March 31st. The Chairman said that the cost of production had decreased from 3·06d. per unit to 2·87d. The manufacturing business had, however, been unfortunate in an unprecedented way, having made bad debts amounting to £1,879. This meant that nothing could be added to the interim dividend paid in August last. They had allowed one or two firms—one in particular—to have credit when they ought not to have done. They were in a large way of business, and the directors were quite unaware that they had a large debenture bond over them, which prevented the Liverpool District Lighting Co. recovering by distraining on the goods supplied. The law in this respect was most anomalous, and many instances of the kind had arisen of late. Mr. Justice Buckley had himself stated that the law in this respect ought to be altered. The directors had taken advice on the matter, and tried to upset the debenture bond, but without success. This was the great reason why they could not declare a dividend. During the present year the sale of electricity had increased by at least 13 per cent. over last year.

A Shareholder said that the company ought to have nothing to do with jobbing in electric lamps and fittings, but stick to the business of supplying electricity as cheaply as possible.

The Chairman said that they could not give up the contract business. To a certain extent it was not worth while doing, but they had a certain preference with their customers. Last year they made a profit of £393 out of the manufacturing and contract business.

The report was adopted.

### Prospectus.

The list opens to-morrow and closes on or before Wednesday next, in an issue at par of 30,000 preference and 40,000 ordinary shares (all £5 each) in the County of Durham Electrical Power Distribution Co., Ltd. The nominal capital of the company is £500,000, and the difference between this figure and the amount of the present issue represents the holding (recently purchased at a premium) of the Newcastle-upon-Tyne Electric Supply Co. The preference shares are entitled to 5 per cent. out of the profits in each year, and after 8 per cent. has been paid on the ordinary shares, they rank for surplus profits up to 8 per cent., and after that *pari passu* with the ordinary for any further dividend declared in excess of 8 per cent. The company has hitherto been controlled from London by the British Electric Traction Co. The board has now been reconstructed, and includes four of the directors, together with the manager, of the Newcastle Co. The object of these alterations is that the undertaking may be under local management. The full prospectus is given among our advertisements in this issue. Out of the present £350,000, there will be paid the liabilities of the Distribution Co., and £50,000 payable to the Newcastle Co. under the new agreement for the supply of current, making £96,430. This will leave £253,570 for further developments, including the works now being executed at a cost of £50,000, and for working capital.

### Thames Ironworks Co.

The report for 1904 is considered by the directors to be the most satisfactory report of the company's work since its incorporation in 1899. The general depression through which the industries of the country have recently passed have fallen comparatively lightly upon the company owing to the large contracts with which the works have been occupied during the last few years, which are now, however, being gradually brought to a close. The engineering works at Greenwich and Deptford had had a record year. The electrical engineering department has been fully employed on Admiralty orders; the results warrant the considerable extensions which are now in progress. An arrangement has been made with the Corporation of West Ham for securing a cheap supply of current, thus enabling the directors to complete the system of electric power throughout the works without incurring further large capital expenditure on generating plant.

### Willans & Robinson, Ltd.

The ordinary general meeting was held on Wednesday at the Cannon Street Hotel, Mr. Mark Robinson presiding over a large attendance.

The Chairman, in proposing the adoption of the report, said he had to bring before them worse figures than any which the history of the company recorded. He had, however, to ask them to analyse the accounts with some some care, so that, while on the one hand, they might be urged to new efforts by the undoubted gravity of the position, they might not, on the other hand, have those efforts weakened by undue discouragement. While the books for the half-year showed a loss of no less than £42,771, the real money loss was considerably smaller—in fact, under £19,000—and that amount might be further reduced if the explanation were extended. No doubt, in some companies it would be held that in such times the writing down of premises and plant and stocks might be suspended, or, at any rate, carried on less vigorously. But they felt confident that they would carry with them the approval of at least the more far-sighted of their shareholders in the bolder policy of extenuating nothing, even if the consequent increase of the debit balance postponed to a later date the hope of recommencing the payment of a dividend. When the corner was turned the position would be found all the sounder, and the recovery all the quicker, through their not having shirked their duty on the way. To enable them to fully understand the situation, it would be necessary to go deeply into the reasons, not only why things had turned out so ill for them, but why they still looked with hope to the future. They ought to set before them all the causes of their misfortunes, which were many, and by no means all upon the surface, or touched upon in any recent discussions. They ought to explain just what were the strong points of the new work they had taken up, and why they believed it would be profitable. But much of all that could not be spoken without injury to the company. They must not take their rivals into their confidence and give them arguments to quote against them, or warnings how to counter their future plans. Referring to the division of certain expenses between Rugby and Queen's Ferry, he said they had also tried to apportion the assets. The whole question of the apportionment of such charges was very difficult, and the directors had not been able to gain much enlightenment from the authorities they had consulted, but they were satisfied that Queen's Ferry bore at least its fair share of charges in the accounts. They had spoken before of extremely unfavourable conditions of trade, and he was afraid some of the shareholders had thought that overmuch was being made of this point. The present figures should, he thought, dispel that opinion if anyone entertained it. Even two years ago, when the bad times had begun, the gross profit for the half-year made wholly in Rugby, stood at £39,797; this time it stood for Rugby at £5,366—nearly £20,000 too little to balance the necessary general charges there. Of course, that fall was due in part to the dulness of trade, implying enlarged shops only partially filled with work. But, in very large part, it was accounted for by the fact that the selling price per horse-power had fallen by some 25 per cent. in the same period, a fall in itself

sufficient to wipe out even a very high rate of profit and turn it into a loss. If, in the Rugby business, that change of trade conditions could turn old-established prosperity into positive loss, they could judge how it was bound to affect a new undertaking such as that at Queen's Ferry, where they were trying to create a trade in competition with established firms, while struggling with troubles and disadvantages which, though mainly accidental and not able to be foreseen, were yet most serious. He was glad to say that there were prospects of improvement in the engine business at Rugby and of some return towards remunerative prices. They held very hopeful views of their new steam turbine business. The success of the earlier turbines already at work had been remarkable. They had made arrangements with the Hon. C. A. Parsons, the famous inventor of the steam turbine in its present form, which removed all fears of litigation, and placed that gentleman's unrivalled experience at their service without burdening their manufacture to a serious extent. It would be a satisfaction to the shareholders to know that Capt. Sankey in quitting the board left behind him a patent which they believed to be of great importance. Under their agreement Capt. Sankey would receive a small royalty upon all turbines ordered after this date. The gas engine was a new departure of more doubtful value. As regarded Queen's Ferry, Mr. Anderson, who had studied the situation there, recommended that the steel works should be re-opened. That was done at the beginning of the current year, and work was re-started with the same staff, the same processes and the same products as before. He could at least say that no money had been lost by re-starting, and if present appearances might be trusted, the steel works were likely to pay their full share of the necessary general charges of the place and to yield a substantial profit. As regarded boiler making, there had been repeat orders enough to justify working in preference to closing. Mr. Anderson had devoted himself to the work of making the best of Queen's Ferry, and had become virtually, though not in name, a managing director. With respect to the reduction of the number of directors, the board were of opinion that that course was eminently wise. It had been suggested that there should be a separate board for Queen's Ferry, but the board could not endorse that scheme. If Queen's Ferry could become a wholly separate though allied company, the separate board would, of course, be right. Everyone desired that solution, but the board was convinced that the way to lead up to it, was to work upon small lines at present until it was proved that there was something worth making a separate company of, and to recognise that even the most tentative working required to be justified by results. The proposed reduction of the board implied a saving of £2,124 per annum in fees, as compared with 1903.

Mr. Clarke seconded the motion.

Mr. Anderson spoke as to the prospects at Queen's Ferry, where he said they were now turning out about 15 tons of excellent steel per week. The future looked hopeful, but of course they could not promise to make the works a success, but they would do their best to that end.

A long discussion ensued, in which several shareholders suggested the advisability of getting rid of the Queen's Ferry works.

Mr. Anderson said the directors had tried all last half-year to sell these works, but without success. They would have had to let them go at scrap value, which he thought would have been a mistake. The works there now had every chance of doing well.

The Chairman having replied at length to the various criticisms passed upon the accounts, the report was adopted.

## Poole and District Electric Traction Co.

Mr. E. Garcke presided at the meeting held at Donington House, W.C., on 28th ult. He moved the adoption of the report, which stated that the additional outlay on capital account during 1904 amounted to £1,390, making the total capital expenditure £69,152. The total receipts from January 1st to December 31st, 1904, amounted to £15,674, and the expenses, including £461 for loan interest, to £10,792, leaving a profit of £4,882, to which should be added £628 brought forward from last account, making £5,510 available for distribution. It is proposed to pay a dividend at the rate of 10 per cent. for the year (£5,000), and to carry forward £510. The number of passengers carried exceeded that of the previous year by 46,124, but whilst more passengers travelled over short distances, there was a marked falling off in the number of passengers who travelled the whole distance between Bournemouth and Poole. This was attributable to the visitors to Bournemouth having been less numerous than usual, and to the Bournemouth Corporation tramways offering additional routes to the visitors, who travel by tramcars for pleasure rather than for business purposes. Early last year efforts were made to agree with the Corporation of Bournemouth as to the price to be paid for the company's undertaking. These efforts were not successful, and it consequently became necessary to refer the matter to arbitration. The hearing occupied 10 days during the period between May and October last, and in December the umpire issued his award, which amounted to £112,000, excluding various agreed sums. Other points arising out of the agreement for sale to the Corporation remain to be settled by another arbitration, but the directors estimate that in any case the distribution which the purchase price will allow will not be less than £17 per share.

Mr. Garcke, after referring to the figures in the report, said that at the last meeting he referred to a contingent liability in connection with a contract made with the B.E.T. Co. and Mr. Murphy in 1901. That contract provided for the construction of the Christchurch line, but in view of the agreement with the Bournemouth Corporation the directors had not deemed it practicable to deal with the construction of that line. The B.E.T. Co. and Mr. Murphy had a claim for loss of profits, and after some negotiations the matter had been arranged by their agreeing to pay them £13,253 by way of compensation for the recission of the contract. In regard to the arbitration proceedings with the Corporation, these dealt only with certain specific matters, and the company was entitled to claim further payments under other clauses of the agreement. This company had formulated its claim, but the Corporation had not yet admitted its liability. Negotiations were still proceeding with regard to the procedure to be adopted for effecting a settlement of the question. He was afraid it would mean further arbitration or litigation. The result of the arbitration was disappointing to the directors. The award would enable a distribution of £17 per share at least, and if the remaining questions were decided in the company's favour, there would be a larger distribution. Until the purchase was completed the company would continue to work the line for its own benefit.

The report was adopted.

## Alliance Electrical Co.

The report for the 23 months ended December 31st, 1904, shows a profit, after deducting directors' fees, expenses of management, and making due provision for depreciation, and adding the balance of £259 brought forward, of £11,941. The directors propose to place £500 to the ledger reserve account, to write £500 off the extension of business account, and declare a dividend at the rate of 4 per cent. per annum on the ordinary shares, carrying forward £303.

The end of January having proved an inconvenient time for the general stock-taking and balancing the books of the company, it has been decided to alter the date of the company's financial year to the end of December. As the contracts in hand at the last balancing time amounted to a figure then unprecedented, the directors considered it advisable to carry the accounts on until the majority of this large work was completed, and this has now been done with satisfactory results. The 23 months under review have been a period of exceptional difficulty, competition having been keen and work scarce. In spite of this the company has been engaged on some of the most important contracts in the United Kingdom. During the period under review the directors have started a new department for dealing with the constantly growing demand for electric power in factories, mines, &c., with headquarters in London, and branch depôts at Manchester, Newcastle and Glasgow, the cost of establishing which has been placed to development of business account to be written off over three years. Several lucrative contracts have already been secured, and the prospects of this new department are most encouraging.

## Chiswick Electricity Supply Corporation.

The report for 1904 presented at the meeting held on March 29th states that satisfactory progress has been made during the year. The business shows a steady increase, and to meet this, extensions have been made from time to time. During the year £10,937 10s. 9d. has been expended on capital account for new machinery, mains, &c. At Chiswick, at the end of 1904, the equivalent of 29,658 lamps was wired to the mains, as compared with 25,159 at the end of 1903; and at Aberystwyth the equivalent of 11,902 lamps as compared with 11,286. Chiswick being a rapidly growing district, there was every reason to believe that the rate of progress indicated by these figures would be fully maintained. During the year the capacity of the Chiswick generating station was increased by the addition of a new 500-H.P. generating set. The station can now supply 50,000 lamps connected to the mains, and efforts are being made to get the new machinery well loaded up without delay. The economy effected by the use of the condenser which started working a year ago, will be apparent from the accounts. The total profit made by the Corporation for the year amounted to £4,371. Out of this sum interest on debentures and loans, amounting to £1,513 has been paid, £185 has been carried to depreciation reserve account, a balance of £2,673 being carried to the credit of profit and loss account. It is proposed to pay a dividend on the ordinary shares at the rate of 4½ per cent. per annum for the year.

## Tynemouth and District Electric Traction Co.

Mr. W. J. Greer presided at the meeting held at Donington House, W.C., on March 31st, and in moving the adoption of the report, he said that trade depression during the year had caused a drop of £1,027 in their traffic receipts. Nevertheless they were able to show a profit of £5,965. The average receipt per passenger was 1·49d., while the average expenditure was ·89d.; the proportion of expenses to receipts was 2 per cent. better than last year. They were paying a final dividend of 9 per cent. per annum on the ordinary shares, making 7 per cent. for the year, were placing £1,500 to depreciation and reserve, and carrying £170 forward. £550, a profit made on premiums from the issue of new shares, had also been put to depreciation. The capital expenditure had been increased by only £899, making the total £86,214. The Whitley Bay extension would be opened in April, and they hoped that with this line and the additional facilities now given to the travelling public in the way of contract tickets, their traffic receipts would not suffer from competition by the electrification of the North-Eastern Railway Co.'s system between Newcastle and Tynemouth. Arrangements had recently been made with the Corporation for the supply of an additional quantity of electrical energy necessary for working the extension. They had made arrangements to appeal against what they considered a very unfair increase in the rateable value of their undertaking by the Tynemouth Union, and the hearing of this appeal would come before the next quarter sessions at Newcastle-on-Tyne.

Mr. J. B. Williamson, J.P., seconded the motion, and it was reed to.

## Babcock & Wilcox, Ltd.

The report for 1904 states that the net profit, after deducting depreciation on plant, &c., amounts to £289,748. To this has to be added the balance brought forward from last account, £26,820 (less £1,050 voted to the directors as bonus), making a balance of £315,519. The interim dividends to June 30th, 1904 (paid October 1st, 1904), of 3 per cent. on the preference shares and of 8 per cent. on the ordinary shares, absorbed £45,400, leaving a balance of £270,119. From this the directors recommend that the following dividends be paid for the half-year ended December 31st:—Dividend of 3 per cent. on the preference shares (from which income-tax is to be deducted), £3,000; dividend of 8 per cent. on the ordinary shares (free of income-tax), £42,400; and bonus of 4 per cent. on the ordinary shares (free of income-tax), £21,200. After placing to the reserve fund £175,000, there remains a balance to be carried forward of £28,519. The directors report increased profits during 1904, the increase being mainly due to important export orders that were executed during the year. As some of the reserve fund now forms part of the working capital, the directors have under consideration a proposal that this should be taken from the reserve fund and added to the capital account.

## Official Announcements re Companies.

The following are to be struck off the register within three months unless cause is shown to the contrary:—

Anglo-American Brush Electric Light Corporation, Ltd.
Askham Bros. & Wilson, Ltd. (Registered November 30th, 1880.)
Blackpool, St. Anne's and Lytham Tramways Co., Ltd. (Registered December 3rd, 1879.)
Boiler Insurance and Steam Power Co., Ltd. (Registered October 1st, 1880.)
Cowper-Coles Zinc Extraction Syndicate, Ltd.
Edison Telephone Co. of London, Ltd.
Electrical Wonder Co., Ltd.
Electric and Magnetic Co., Ltd.
Electric Tramcar Syndicate, Ltd.
Harrogate Electro-Hydropathic Co., Ltd.
Herculite and Electrical Manufacturing Co., Ltd.
New British Incandescent Electric Lamp Co., Ltd.
Reno Electric Stairways and Conveyors, Ltd. (Registered February 20th, 1902.)
Tramways Corporation, Ltd.
Tramways Share Investment Co., Ltd.
Tramway Starting and Stopping Co., Ltd.

## Rhodes Electrical Manufacturing Co.

The first annual meeting of the shareholders of this company was held on Thursday of last week at 71, Bishopsgate Street Within. Mr. A. L. Rhodes presided, and moved the adoption of the report, which, notwithstanding the general depression of trade and keen competition, was considered to be on the whole very satisfactory.

After providing for all managerial and other expenses, including bad debts, depreciation of plant and machinery at the rate of 10 per cent. per annum, putting to reserve 20 per cent. for goods out on approval and depreciating heavily all patterns, the net profits for the year amounted to £3,714. Interim dividends paid on June 11th and November 8th, 1904, at the rate of 6 per cent. per annum, absorbed £1,843. It was proposed to write off approximately half the preliminary expenses, viz., £200, to carry £800 to reserve (the estimated proportion of profit from November 28th, 1903, to March 4th, 1904), and declare a further final dividend at the rate of 6 per cent. per annum for the remaining three months of the last financial year, viz., from September 1st to December 3rd, 1904, absorbing approximately £620, leaving approximately £251 to be carried forward to next year's account.

The Chairman said he thought they had reason to congratulate themselves on a satisfactory year's trading, especially in view of the very keen competition that existed in the motor trade. Thanks to an excellent organisation they were in a position to meet that competition, and still to make profits. During the year they had made considerable progress in developing a new line of alternating-current motors, especially the single-phase type. They were practically the only people in England who were making that type of motor, and that was a very good position to be in. He felt confident that there was a splendid future before the company. During the past year they had made considerable additions in up-to-date tools, which had tended to reduce the cost of manufacture, and they had secured the services of an alternating current expert, who was likely to prove of considerable advantage to the company.

Mr. J. A. Halford, in seconding the motion, said it would be seen that they had made a reserve of £200 in the accounts for income-tax. He was glad to say that £140 of that had since been returned, so that, really, they had a carry-over of nearly £400 in place of the £251 shown in the balance-sheet. As to the sales department of the company, that was progressing very satisfactorily, and in the three months of the present financial year they had done about 20 per cent. more than in the corresponding period of last year. Up to October last all their trade was done practically from the London office, but since then they had started branch offices practically all over the kingdom, which were already answering well. They felt confident that that new scheme of having their own representatives was going to pay them very well. He believed they would show a greatly-increased turnover this year, and, with reduced working expenses, they hoped to be able to make the same profits, despite the lowered prices which they would have to meet.

The report was adopted.

## Anglo-Argentine Tramways Co.

The report for 1904 states that the gross receipts amounted to £418,093 and working expenses to £227,528. Deducting debenture interest and sinking fund, the net profit is £174,003. The amount transferred to reserve fund is £10,000, and to renewals fund £25,000. The directors recommend a final dividend of 5s. per share upon the ordinary shares, absorbing £42,500, which will make 8s. per share, or 8 per cent. for the year, and that the balance of £5,922 be carried forward. The working expenses amount to 54·42 per cent., as compared with 53·02 per cent. in 1903. The gross receipts for the year as compared with 1903 show an increase of £89,099, and the expenses an increase of £53,102. The item "premium on debenture stock," amounting to £38,635, for some years appearing on the debit side of the balance-sheet, has been written off "cost of concessions, &c." The company took over the City of Buenos Ayres Tramways Co.'s system on January 1st last. The electrical conversion of those lines is in active progress, and will, it is expected, be completed within the next 18 months. Towards the end of last year a strike occurred amongst the employés of some of the railway and tramway companies in Buenos Ayres. This company was not directly affected, but the result was that a general and uniform scale of revised wages and hours of labour was adopted by all the electrical tramway companies. The traffic receipts of the combined systems from January 1st to March 25th show an increase of £13,685, in comparison with the corresponding period of 1904.

## Potteries Electric Traction Co.

The directors' report for 1904 says that the gross receipts amount to £103,295. After deducting all expenses chargeable to revenue, including repairs and maintenance and interest on loans and debenture stock, there remains a profit of £26,705. To this has been added £766 brought forward from the previous account, making an available balance of £27,471, which the directors recommend should be applied as follows:—

| | |
|---|---|
| Depreciation and reserve fund .. .. .. .. .. .. | £2,500 |
| Dividend on the 5 per cent. cumulative preference shares .. | 12,250 |
| Dividend on the ordinary shares at the rate of 5 per cent. for the year.. .. .. .. .. .. .. .. .. | 12,249 |
| To carry forward to next account .. .. .. .. .. | 472 |
| | £27,471 |

An issue of £25,000 4½ per cent. debenture stock was made in May last. The capital expended during the year amounted to £16,730 7s. 4d., which provided for the Harishill and Sneyd Green extensions, &c. These two extensions were opened for public traffic on February 23rd, 1904, and July 7th, 1904, respectively. An application recently made to the Board of Trade for an extension of time for the construction of some of the railways authorised by the Potteries Light Railways (Extensions) Order, 1902, and for the abandonment of others has been granted. Arrangements have been made with the local authorities concerned for the company to construct some of these railways within one year, and others within two years. It has been decided to test the traffic possibilities of routes beyond the existing tramways and light railways by means of motor-omnibuses, and three such vehicles are on order, and will shortly be delivered. It is proposed to commence in April a service between Newcastle and Trentham, and it is probable that other routes will be tested in due course with a view to feeding the company's existing lines. The parcels traffic continues to show a satisfactory rate of increase.

| | Year ended Dec. 31st, 1903. | Year ended Dec. 31st, 1904. |
|---|---|---|
| Miles open—Route miles .. .. | 28·95 miles | 30·68 miles |
| Single line.. .. .. | 21·79 „ | 22·93 „ |
| Double line .. .. | 7·16 „ | 7·75 „ |
| Number of passengers carried.. .. | 14,934,048 | 16,403,351 |
| Average traffic receipts per passenger | 1·33d. | 1·30d. |
| Average expenditure per passenger .. | 0·79d. | 0·75d. |
| Proportion of expenses to receipts .. | 59% | 58% |
| Number of cars in stock.. .. .. | 105 | 105 |

## Calcutta Tramways Co.

The report for 1904 shows gross traffic receipts £127,780, working expenditure under all heads £64,553, and a revenue balance, after crediting sundry receipts, of £63,513. The interest on debentures, less the amount earned by the employment of moneys in hand, has taken £14,255, and the interim dividend paid in October last £15,340, leaving £33,917, in addition to the amount brought in from the accounts of 1903, £2,351, or in all £36,268 to be now dealt with. A premium of £6,557, obtained on shares sold, has been credited to the depreciation fund. From the net revenue balance of £36,268 the directors propose to allocate a further sum of £8,442 to the depreciation fund, making a total addition for the year of £15,000, and bringing the amount at credit of that account to £42,792. The directors recommend a final dividend of 5s. per share, absorbing £26,250, which, with the interim dividend, makes 8 per cent. for the year, and £1,576 is carried forward. During the year large sums have been expended in consolidating and improving the system, and in preparing for the additional demands which will be made upon its resources to meet the requirements of the extensions shortly to come into operation, as well as those which are rendered necessary by the expansion now taking place on the existing system

## Guildford Electricity Supply Co.

Dr. F. R. Russell presided at the meeting held on Friday last. In referring to the accounts, he said that the gross profit was £2,519, or 6 per cent. on the capital, against £1,591, or 4·2 per cent. in the preceding year. The units sold had increased from 145,804 to 211,374. A large proportion of this increase was due to the power demand; in 1903 they sold only 9,185 units for power, but in 1904 it was 28,269 units. The lighting output had increased from 136,619 units to 183,105. A Diesel oil engine had been put in. As further plant would be required this year, new capital was to be issued. They had at present 15,000 debentures at 6 per cent., and a first charge was held by the bank on £6,000. It was the proposal of the directors that this be paid off, and that a new issue of £25,000 first debentures at 5 per cent. be issued. That they hoped to be able to carry out during the present year.

**Madras Electric Tramways (1904).**—A meeting of this company was held at the offices, Dashwood House, Old Broad Street, on Thursday. A representative of the Electrical Review who attended was informed that the meeting was private and was of no public interest. He was further informed that there was no directors' report.

**Kidderminster Electric Lighting and Traction Co.**—The gross receipts for 1904 were £6,300, including £2,000 as dividend on 5,720 3½ per cent. shares held in the Kidderminster and Stourport Electric Tramway Co. After paying the preference dividend, £500 is applied to depreciation and reserve. The meeting of the company was held yesterday at Donington House.

**South Wales Electrical Power Distribution Co.**—The meeting of this company was held at Cardiff on Saturday last, Mr. Robert Forrest presiding. The chairman said that all the difficulties in obtaining plant from the different contractors were at an end. The company's stations were all at work. Another difficulty had, however, arisen, namely, that the company's customers had experienced the same delay in getting their plant delivered, the result being that the company were two years late in obtaining the substantial revenue which their orders would eventually give them. Although this delay had been rather discouraging, it had its gratifying feature, as customers, who were rapidly increasing, had come for a supply of energy after having satisfied themselves of the great benefits of a cheap supply always "on tap" and ready for use. Mr. W. S. M'Laren seconded the adoption of the report, and it was agreed to.

**Indo-European Telegraph Co.**—The directors recommend a dividend for the six months ending December 31st, 1904, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax. They recommend a special distribution of 15s. per share, free of income-tax, out of the interest accrued during the year upon the reserve fund investments. The above will be payable on and after May 1st next to shareholders registered on the 25th inst. The transfer books will be closed from the 12th to the 25th inst., both inclusive.

**Direct United States Cable Co.**—Interim dividend of 3s. per share (at the rate of 3 per cent. per annum) for the quarter ending March 31st, 1905.

**Oriental Telephone and Electric Co.**—The directors recommend the following dividends:—At the rate or 6 per cent. per annum on the preference shares for the half-year ending December 31st last, less income-tax; a final dividend of 3½ per cent. on the ordinary shares issued, free of income-tax, making a total of 6½ per cent. for the year. The share transfer books will be closed from April 17th to 28th.

**Merthyr Electric Traction and Lighting Co.**—The directors in their report for the past year state that the gross receipts on the light railways for the year amount to £10,631, and the gross receipts on account of electrical supply to £3,775, making, with £55 sundry receipts, a grand total of £14,460. After deducting expenses amounting to £12,345 (which includes £1,793 for debenture and other interest), and adding the balance brought forward, £187, there remains £2,301 available for distribution. The directors recommend that this should be applied as follows:—To reserve and depreciation fund £500, and dividend on preference shares to December 31st, 1904, £1,500, leaving to be carried forward £301. The meeting of the company was held yesterday morning at Donington House, W.C.

**W. T. Glover & Co., Ltd.**—The annual meeting of the shareholders of this company was held on Thursday last week at the offices of the company, Trafford Park, Manchester. Mr. A. L. Ormerod presided, and moved the adoption of the report. He stated that the general financial position of the company had improved considerably during the preceding three years. Last year was even better than 1903. The directors, however, did not yet see their way to the payment of a dividend. A sum of £3,648 had been carried to the reserve fund, which now stood at £12,000; and the amount standing to the credit of profit and loss account, £7,976, would be carried forward. The report was adopted, and the retiring directors were re-elected.

**Urban Electric Supply Co.**—A meeting of this company was held yesterday at Westminster Palace Hotel.

## STOCKS AND SHARES.

Wednesday Evening.

Now that the first quarter of the year has been satisfactorily turned, it is hoped that the Bank Rate may soon decline to that 2 per cent. minimum which would enliven the investment markets generally. Authorities are divided as to whether the anticipated change may be brought about this month or not, and in the meantime Stock Exchange prices are moving slowly. The immense volume of recent new issues will take some little time to assimilate, and until strong hands take charge of some of the floating stock in the markets, a further rise cannot be expected to hurry.

Electricity Supply shares still show traces of the vague uneasiness amongst investors that has been generated by the proposed London Power Bill. The declines in quotations are in several cases due to a widening of the price on the downward grade, leaving the higher price unaltered. Dealers in the market admit that some of these changes are only precautionary measures on their part, lest they should have to buy more shares than they want at the earlier figures. Brompton and Kensington Ordinary are *ex* 5s. 6d., but have dropped 10s. to 10, the Preference being ¼ easier at the same price, *ex* 3s. 6d. interest. Taking the list categorically, Charing Cross are ¼ down at 8, the Preference ⅛ at 5⅝, Chelseas ¼ at 6¾, and County ½ at 9½, *ex* 5s. County Preference have been lowered only 5s. to 12½, although the dividend is 6s., and the two Urban shares are both ⅛ down, this being the exact amount of the dividend deducted from both. Debenture issues have come somewhat on offer, but the falls are very slight, and a few were altered automatically upon the taking-off of the interest from the prices.

Edison & Swan Second Debenture recovered 1½ per cent. of the dividend, standing now at 87½. Electric Constructions have picked up $\frac{1}{16}$ of their last week's loss, and are back to $1\frac{3}{16}$. There is ¼ rise in British Aluminium 7 per cent. Preference to 5 middle, and Industrial shares, as a whole, have been steady. Large dealings in Babcock & Wilcox are a feature of the Miscellaneous Market, and the price has jumped to 5⅛, a rise of 12s. 6d. on the week. The Preference are unchanged at $1\frac{9}{16}$. Willans & Robinson Ordinary at 1½, and the Preference at 2½, have become exceedingly inanimate. Henleys drooped to 12½, a fall of 5s. upon the settlement of the new 5,000 Ordinary shares. British Insulated Wire are the same fraction down at 5⅝, of which decline 4s. is represented by the dividend just off.

After Great Northerns, Indo-Europeans. The former are resting after their dramatic rise, with an advance of only 10s. to their credit this week, but Indos have put on £2 a share at 50, on the special bonus of 3 per cent. which shareholders are to receive, the interest accrued upon investment of the reserve fund. This, of course, is a solatium not to be looked for regularly. As a whole, the Telegraph market is quieter. Anglo-American varieties exhibit unusual steadiness; Anglo "B" shed ½ at 108, and the "B" ¼ at 15⅝. The Eastern groups are without feature. Eastern Ordinary went back another point to 144½, despite the interim dividend, but the Debenture stock is 1 better at 109. Apart from these movements, the only noticeable prices are Western Telegraphs and Direct Spanish Ordinary and Preference, each of the trio having recovered the dividends deducted. Amazon Debentures have again advanced 1 per cent. National Telephone issues are heavier, the Preferred being ½ down at 109½, the Deferred a point at 103, and the Second Preference 10s. at 12. But the company's Third Preference hardened ⅛ to 5⅝. None of the other telephone descriptions have moved.

Baker Street and Waterloo Debentures are to have their special settlement next week, and the price keeps steady at 2⅝ premium. Railway stocks excite no public interest nowadays. Central London's are as quiet as ever, but City and South London dropped ½ to 44½. Districts are not better than 41¼, and Metropolitans stay at 97. Notwithstanding the crowds which thronged each line last Saturday, the Boat Race day, the traffics are merely mediocre. A further fall of 2s. 6d. leaves Westinghouse Preference at 3, the price being allowed to slide away now that the slight demand has been satisfied. British Electric Tractions, too, are dull, the Ordinary being 9¼ rather sellers. Apparently the motor-'bus scare dies hard. London United Tramways Preference are 10¼, and the Debenture stock is a fraction over par. The company commenced its latest work of extension the other day, so a capital issue will probably be mooted before long. Mr. Clifton Robinson told a newspaper representative that for the Surrey part of the lines the power would be obtained from the Chelsea station of the Underground Railways.

A good report leaves Calcutta Tramways at 8⅞, but the advance in the dividend with a lowering of the carry-forward comes in for some gentle criticism. Anglo-Argentine Trams rose their usual fraction to $8\frac{1}{16}$. Barcelonas at 12¼ are firm upon the excellent dividend of 12s. per share. Metropolitan Electric Tramways Deferred are a few pence easier at 8s. 6d. The rarity of dealings in New General Tractions makes a purchase at 25s. on Tuesday a noticeable event; the shares are of £5 each, fully paid, and the last dividend was distributed in May, 1901. Potteries at 10 for the Ordinary, and 9¾ for the Preference, maintain their recent improvement, but the report is rather a colourless one. A new Preference issue is being made by the County of Durham Electrical Power Distribution Co., and the full prospectus appears in this issue. South Wales Ordinary shares continue dullish at about 8½, but the Debenture stock at 110 is a good market.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. ‡ | Dividends for the last three years. 1903. | 1903. | 1904. | Closing Quotations March 29th. | Closing Quotations April 5th. | Business done week ended April 5th, 1905. Highest | Lowest |
|---|---|---|---|---|---|---|---|---|---|
| 67,100 | African Direct Telegraph, 4 % Debs. | 100 | .. | .. | .. | 99 —102 | 99 —102 | 101½ | .. |
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | .. | .. | .. | 2¼— 2⅝ | 2¼— 2⅝ | .. | .. |
| 119,700‡ | Do. do. 5 % Debs., Nos. 1 to 1,250 Red. | 100 | .. | .. | .. | 71 — 76 | 74 — 77 | .. | .. |
| 788,840 | Anglo-American Telegraph | Stock | 60/6 | 61s. | 2⅜% | 61 — 63 | 61 — 63 | 62 | .. |
| 3,105,580 | Do. do. do. 6 % Pref. | Stock | 6 % | 6 % | 5⅛% | 108 —109 | 107½—108½ | 108⅜ | 107⅜ |
| 3,105,580 | Do. do. do. Deferred | Stock | 1/- | 2s. | Nil | 15⅞— 16⅛ | 15⅝— 16⅛ | 16⅛ | 15⅞ |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 | 5 | 6 % | 7 % | .. | 6⅜— 6⅝ | 6⅜— 6⅝ | .. | .. |
| 13,888,800$ | Commercial Cable | $100 | 8 % | .. | .. | 230 —240 | 230 —240 | .. | .. |
| 1,841,909 | Do. do. Sterling 500 year 4 % Deb. Stock Red. | Stock | .. | .. | .. | 98 —100 | 97 — 99 xd | 98⅜ | .. |
| 16,000 | Cuba Telegraph | 10 | 6⅔% | 5 % | .. | 8¾— 9¼ | 8¾— 9¼ | .. | .. |
| 6,000 | Do. 10 % Pref. | 10 | .. | .. | .. | 17 — 18 | 17 — 18 | .. | .. |
| 12,981 | Direct Spanish Telegraph, Ord. | 5 | .. | .. | .. | 8⅜— 8⅝ | 8⅜— 8⅝ xd | .. | .. |
| 6,000 | Do. do. 10 % Cum. Pref. | 5 | .. | .. | .. | 9⅛— 9 | 8⅝— 9 | .. | .. |
| 80,000 | Do. do. 4½ % Debs. | 50 | .. | .. | .. | 101 —103 | 101 —103⅝ | .. | .. |
| 60,710‡ | Direct United States Cable | 20 | 8½% | 3 % | .. | 11⅜— 11⅝ | 11⅜— 11⅛ | 11⅞ | 11⅝ |
| 78,500 | Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,900, Red. | 100 | .. | .. | .. | 100 —102 | 100 —102 | .. | .. |
| 4,000,000 | Eastern Telegraph, Ord. Stock | Stock | 7 % | 7 % | .. | 144 —147 | 143 —146 | 146 | 143½ |
| 1,955,555 | Do. 8½ % Pref. Stock | 100 | .. | .. | .. | 92 — 94 | 92 — 94 | 93½ | 92½ |
| 1,594,645 | Do. 4 % Mort. Deb. Stock Red. | Stock | .. | .. | .. | 107 —109 | 108 —110 | 109½ | .. |
| 800,000 | Eastern Extension, Australasia, and China Telegraph | 10 | 7 % | 7 % | .. | 14½— 14⅝ | 14½— 14⅝ | 14⅞ | 14½ |
| 880,000‡ | Do. 4 % Deb. Stock | Stock | .. | .. | .. | 105 —107 | 105 —107 | 107½ | .. |
| 800,000 | Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909 | 100 | .. | .. | .. | 100 —102 | 100 —102 | 100 | .. |
| 800,000‡ | Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000 | 25 | .. | .. | .. | 101 —103 | 101 —103 | 101½ | .. |
| 120,227 | Globe Telegraph and Trust | 10 | £3 16 7* | 5½% | .. | 10⅞— 11 | 10⅝— 11 | 10⅝ | 10⅜ |
| 120,042 | Do. do. 6 % Pref. | 10 | .. | .. | .. | 14⅜ — 14⅝ | 14⅜ — 14⅞ | 14⅝ | 14⅜ |
| 120,000 | Great Northern Telegraph, of Copenhagen | 10 | 12½% | 15 % | 24 % | 38 — 40 | 38½ — 40½ | 39¼ | 39 |
| 50,600 | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. | 100 | .. | .. | .. | 100 —102 | 100 —102 | .. | .. |
| 17,000 | Indo-European Telegraph | 25 | 10% | 10 % | 13 % | 47 — 49 | 49 — 51 | 49⅜ | .. |
| 72,680 | Monte Video Telephone Co., Ltd., Ord. | 1 | 3 % | 3 % | .. | ⅞— 1 | 1⅛— 1⅛ | 1⅛ | .. |
| 1,963,333 | National Telephone, Pref. Stock | 100 | 6 % | 6 % | 6 % | 109½ —110½xd | 109 —110 | 110½ | 10 ⅜ |
| 1,966,667 | Do. do. Def. Stock | 100 | 4½% | 5 % | 5 % | 103 —105 xd | 102 —104 | 1.4 | 1 3 |
| 15,000 | Do. do. 6 % Cum. 1st Pref. | 10 | 6 % | 6 % | 6 % | 12½ — 13½xd | 12½ — 13½ | .. | .. |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. | 10 | 6 % | 6 % | 6 % | 12 — 13 xd | 11⅞ — 12⅞ | 13⅛ | 1 1⅝ |
| 2,250,000 | Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000 | 5 | 5 % | 5 % | 2½% | 5⅝— 5⅞xd | 5½ — 5⅝ | 5 7/16 | 5⅛ |
| 000,000‡ | Do. do. 3½ % Deb. Stock Red. | Stock | 3½% | 3½% | 4 % | 100 — 102 | 100 — 102 | .. | .. |
| 689,593 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | .. | 10⅛ —105½ | 103½—105½ | 104½ | 10 ½ |
| 179,318 | Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid | 1 | 6 % | 6½% | .. | 1⅛— 1⅜ | 1⅛— 1⅜ | 1¼ | .. |
| 50,000 | Do. do. 6 % Cum. Pref. | 1 | .. | .. | .. | 1 3/16— 1 5/16 | 1 3/16— 1 5/16 | .. | .. |
| 100,000 | Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 | 100 | .. | .. | .. | 99 —102 | 99 —102 | .. | .. |
| 11,889‡ | Reuter's | 8 | 5 % | .. | .. | 7½— 7⅝ | 7½— 8 | .. | .. |
| 3,808 | Submarine Cables Trust | Cert. | .. | .. | .. | 125 —128 | 125 —128 | .. | .. |
| 58,000 | United River Plate Telephone | 5 | 7 % | .. | .. | 7 — 7½ | 7 — 7½ | .. | .. |
| 40,000 | Do. do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | .. | .. | .. | 6 — 6½ | 5 — 5½ | .. | .. |
| 179,947 | Do. do. 5 % Debs. | Stock | .. | .. | .. | 107 —109 | 107 —109 | .. | .. |
| 15,609‡ | West African Telegraph, Shares | 10 | 2 % | 4 % | .. | 8 — 8½ | 8 — 8¼ | .. | .. |
| 80,008 | West Coast of America, 1 to 80,000 and 53,001 to 53,009 | 2½ | .. | .. | .. | 7/16— 7/8 | 7/16— 7/8 | .. | .. |
| 150,000 | West Coast of America, 4% Debs., 1 to 1,500 guar. by Bras. Sub. Tel. | 100 | .. | .. | .. | 100 —102 | 100 —102 | .. | .. |
| 267,980‡ | Western Telegraph, Ltd., Nos. 1 to 207,980 | 10 | 7 % | 7 % | .. | 13⅛— 14½ | 13⅛— 14½ xd | 13⅞ | 3½ |
| 75,000 | Do. do. 5 % Debs. 2nd series, 1906 | 100 | .. | .. | .. | 101 —103 | 101 —103 | .. | .. |
| 400,000‡ | Do. do. 4 % Deb. Stock Red. | 100 | .. | .. | .. | 103 —105 | 103 —105 | .. | .. |
| 86,821 | West India and Panama Telegraph | 10 | .. | .. | .. | 13/16— 15/16 | 13/16— 15/16 | 7/8 | 1/16 |
| 84,868 | Do. do. do. 6 % Cum. 1st Pref. | 10 | .. | .. | .. | 8¾— 9 | 8¾— 9 | 8⅞ | 8⅝ |
| 4,669 | Do. do. do. 6 % Cum. 2nd Pref. | 10 | .. | .. | .. | 8 — 8½ | 8 — 8½ | 8⅜ | 8¼ |
| 80,000‡ | Do. do. do. 5 % Debs., Nos. 1 to 1,800 | 100 | .. | .. | .. | 103 —105 | 103 —105 | .. | .. |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 90,000 | British Aluminium 7 % Cum. Pref. | 5 | .. | .. | .. | 4⅛— 5 | 4⅛— 5⅛ | .. | .. |
| 10,000 | Do. do. "A" 6 % Cum. Pref. | 5 | .. | .. | .. | 4⅜— 5⅛ | 4⅜— 5⅛ | 5 | .. |
| 800,000‡ | Do. do. 5% 1st Mort. Deb. Stock Red. | Stock | .. | .. | .. | 98 —102 | 99 — 103 | .. | .. |
| 100,000 | British Electric Traction | 10 | 8 % | .. | .. | 9⅛— 9⅜ | 9 — 9⅛ | 9⅛ | 9⅛ |
| 100,000 | Do. do 6 % Cum. Pref. | 10 | .. | .. | .. | 10¾— 11⅛ | 10⅜— 11⅛ | 11 | 9⅛ |
| 600,000‡ | Do. do. 5 % Perpetual Debenture Stock | Stock | .. | .. | .. | 123 —125 | 121 —123 xd | 121½ | 121 |
| | Do. do. 4½% 2nd Deb. Stock Red. | 100 | .. | .. | .. | 95 — 97 | 98 — 100 | 98⅜ | .. |
| 100,000 | British Insulated and Helsby Cables | 5 | 10 % | 8 % | 8 % | 5⅜— 6⅛ | 5¾— 6 | 5⅞ | .. |
| 100,000 | Do. do. 6 % Cum. Pref. | 5 | .. | .. | .. | 5⅝— 6 | 5⅝— 6 | .. | .. |
| 50,000 | Do. do. 4½ % 1st Mort. Deb. Red... | 100 | .. | .. | .. | 101 —104 | 101 —104 | 103⅜ | .. |
| 50,000 | ¶Browett, Lindley & Co., Ord. | £1 | .. | .. | .. | ⅝— ¾ | ⅝— ¾ | .. | .. |
| 50,000 | ¶ Do. do. 6 % Cum. Pref. | £1 | .. | .. | .. | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. |
| 105,731 | Brush Electrical Engineering, Ord., 1 to 105,731 | 2 | Nil | Nil | .. | ½— ¾ | ½— ¾ | 11/16 | .. |
| 150,000 | Do. do. Non-cum. 6 % Pref. | 2 | 6 % | 6 % | .. | 1½ — 2 | 1½ — 2 | 1 13/16 | .. |
| 125,000‡ | Do. do. 4½ % Perp. Deb. Stock | Stock | .. | .. | .. | 92 — 96 | 92 — 96 | .. | .. |
| 125,000‡ | Do. do. 4½ % Perp. 2nd Deb. Stock | Stock | .. | .. | .. | 79 — 82 | 79 — 82 | 81 | .. |
| 85,000 | Callender's Cable Construction shares | 5 | 15 % | 15½% | .. | 11 — 11½ | 11 — 11½ | .. | .. |
| 40,000 | Do. do. do. 5 % Cum. Pref. | 5 | .. | .. | .. | 6⅛— 6¼ | 5⅞— 6¼ | .. | .. |
| 90,000‡ | Do. do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | .. | .. | .. | 106 —108 | 107 —109 | 108 | .. |
| 1,860,014 | Central London Railway, Ord. Stock | Stock | 4 % | 4 % | .. | 93 — 95 | 92 — 94 | 93½ | 93 |
| 494,998 | Do. do. 4 % Pref. Stock | Stock | 4 % | 4 % | .. | 101 —103 | 101 —103 | .. | .. |
| 494,998 | Do. do. Def. do. | Stock | 4 % | 4 % | .. | 83 — 86 | 83 — 86 | .. | .. |
| 1,880,000 | City and South London Railway | Stock | 2½% | 2½% | 2½% | 44½ — 45½ | 44 — 45 | 45 | 44½ |
| 86,000 | Crompton & Co., Nos. 1 to 86,000 | 5 | 6 % | .. | .. | 2⅝ — 2⅞ | 2⅞ — 2⅞ | .. | .. |
| 100,000‡ | Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red. | .. | .. | .. | .. | 93 — 98 | 93 — 98 | .. | .. |
| 99,261 | Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261 | 5 | Nil | .. | .. | 1 — 1½ | 1 — 1½ | .. | .. |
| 17,189 | Do. do. "A" shares, 01—017,189 | 5 | Nil | .. | .. | 1⅜— 2⅛ | 1⅜— 2⅛ | .. | .. |
| 844,028‡ | Do. do. 4 % Deb. Stock Red. | 100 | .. | .. | .. | 89 — 85 | 80 — 85 | .. | .. |
| 100,000‡ | Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | .. | .. | .. | 86 — 91 | 85 — 90 xd | .. | .. |
| 112,100 | lectric Construction 1 to 112,100 | 2 | 6 % | 4 % | .. | 1 — 1⅛ | 1⅛ — 1⅛ | .. | .. |
| 81,390 | Do. do. 7 % Cum. Pref., 1 to 81,390 | 2 | .. | .. | .. | 2⅛— 2⅜ | 2⅛— 2⅜ | .. | .. |
| 82,500‡ | Do. do. 4 % Perp. 1st Mort. Deb. Stock | Stock | .. | .. | .. | 97 — 99 | 97 — 99 | .. | .. |
| 25,000 | General Electric Co., (1900), 5 % Cum. Pref. | 10 | 5 % | .. | .. | 9½— 10 | 9⅝— 10 | 9½ | .. |
| 200,000 | Do. do. 4 % Mort. Deb. | Stock | .. | .. | .. | 91 — 96 | 97 101 xd | .. | .. |
| 200,000 | Henley's (W. T.) Telegraph Works, Ord. | 5 | 20 % | 15 % | 15 % | 12⅛ — 13 xd | 12⅛ — 12⅜ | .. | .. |
| 200,000 | Do. do. 4½ % Pref. | 5 | .. | .. | .. | 5⅝ — 6⅛ | 5⅝ — 6⅛ | 6½ | .. |
| 45,900 | Do. do. 4½ Mort. Deb. Stock | Stock | .. | .. | .. | 102 —111 | 109 —111 | .. | .. |
| 60,000 | India-Rubber, Gutta-Percha & Telegraph Works | 10 | 10 % | .. | .. | 15 — 17 | 16 — 17 | .. | .. |
| 800,000‡ | Do. do. 4 % 1st Mort. Deb. | 100 | .. | .. | .. | 100 —103 xd | 100 —103 xd | .. | .. |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | 1½% | 1½% | 1½% | 8½— 8⅝ | 8½— 8⅝ | .. | .. |
| 10,000 | † Do. do. Pref. £10 paid | 10 | .. | .. | .. | 9⅛— 9⅜ | 9⅛— 9⅜ | .. | .. |
| 37,350 | Telegraph Construction and Maintenance | 12 | 20 % | 20 % | 15 % | 36 — 38 xd | 36 — 38 | 36⅛ | .. |
| 150,000‡ | Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909 | 100 | .. | .. | .. | 103 —105 | 103 —105 | .. | .. |
| 840,000‡ | Waterloo & City Railway, Ord. Stock | 100 | 3½% | 3½% | 3½% | 92 — 94 | 92 — 94 | .. | .. |

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List

Bank rate of discount 2½ per cent. (March 9th, 1905).

## SHARE LIST OF ELECTRICAL COMPANIES (*continued*).— ELECTRICITY SUPPLY COMPANIES.

| Present Issue. | NAME. | Stock or Share.‡ | Dividends for the last three years 1902. | 1903 | 1904. | Closing Quotations Mar. 29th. | Closing Quotations April 5th. | Business done week ended April 5th, 1905. Highest | Lowest |
|---|---|---|---|---|---|---|---|---|---|
| 20,000 | Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 .. | £ | 8 % | 10 % | 10 % | 10 — 11 | 9¼— 10⅜xd | 10⅜ | .. |
| 20,000 | Do. do. 7 % Cum. Pref. .. | £ | .. | .. | .. | 10 — 10½ | 9½— 10½ | .. | .. |
| 250,000 | Central Electric Supply 4 % Guar. Deb. Stock .. .. .. .. | 100 | .. | .. | .. | 105 —108 | 105 —108 | .. | .. |
| 50,000 | Charing Cross and Strand Electricity Supply .. .. .. .. | £ | 10 % | 8 % | 8 % | 8 — 8¾ | 7¼— 8¼ | 8⅛ | 7⅞ |
| 70,000 | Do. do. do. 4½% Cum. Pref. .. | £ | .. | .. | .. | 6⅛ — 6⅝ | 6⅜— 6⅝ | 5 31/32 | 5½ |
| 40,000 | Do. do. "City Undertaking" 4½% Cum. Pref. .. | £ | .. | .. | .. | 5 — 5⅛ | 5 — 5⅛ | .. | .. |
| 40,000 | Do. do. 1903 .. .. .. .. .. | £ | .. | .. | .. | 5 — 5⅛ | 5 — 5⅛ | .. | .. |
| 250,000 | Do. do. 4 % Deb. Stock Red. .. .. .. .. | 100 | .. | .. | .. | 105 —107 | 105 —107 | 105½ | .. |
| 44,488 | *Chelsea Electricity Supply, Ord. .. .. .. .. .. | £ | 4½% | 5½% | 6 % | 6⅝ — 7¼ | 6¾— 7 | .. | .. |
| 150,000‡ | Do. do. % Deb. Stock Red. .. .. .. .. | Stock | .. | .. | .. | 109 —111 | 109 —111 | .. | .. |
| 70,595 | City of London Electric Lighting, Ord. 40,001—110.595 .. | 10 | 5 % | 5 % | 6 % | 11 — 12 xd | 11 — 12 | 11¼ | 11⅛ |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 .. .. .. .. | 10 | .. | .. | .. | 12½— 14 xd | 12⅜— 14 | 13 15/16 | .. |
| 400,000‡ | Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid .. | .. | .. | .. | .. | 128 —127 | 128 —127 | .. | .. |
| 800,000 | Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid .. | 100 | .. | .. | .. | 103 —105 | 103 —105 | 105 | 104¾ |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 .. .. | 10 | 4 % | 4 % | 4½% | 9¼— 10 | 9 — 9⅛xd | 9⅜ | 9⅛ |
| 20,000 | Do. do. do. 6 % Pref., 40,001—60 .. | 10 | .. | .. | .. | 12½ — 12¾ | 12 — 12⅛xd | 12 7/8 | .. |
| 400,000‡ | Do. do. 4½% Deb. Stock .. .. .. .. | .. | .. | .. | .. | 110 —113 | 110 —113 | 112⅜ | .. |
| 250,000‡ | Do. do. 4½% 2nd Deb. Stock .. .. .. .. | Stock | .. | .. | .. | 104 —106 | 104 —106 | .. | .. |
| 70,000 | Edmundson's Electric Corporation, Ord. Shares .. .. .. | £ | 7 % | 7 % | .. | 6⅞— 6⅞ | 6 — 6½ | 6 3/8 | 6 |
| 70,000 | Do. do. 6 % Cum. Pref. .. .. .. | £ | .. | .. | .. | 6⅝— 6⅝ | 6½— 6⅝ | 6 7/8 | 6¾ |
| 800,000‡ | Do. do. 4½% 1st Mort. Deb. Stock .. | 100 | .. | .. | .. | 106 —108 | 106 —108 | .. | .. |
| 21,000 | Kensington and Knightsbridge Electric Ord. .. .. .. .. | £ | 10 % | 12% | 12 % | 12 — 13 | 12 — 13 | 13⅜ | .. |
| 90,000 | Do. do. do. 4 % Debenture Stock .. | Stock | .. | .. | .. | 102 —104 | 101 —103 xd | .. | .. |
| 110,000 | London Electric Supply Corporation, Limited, Ord. .. .. .. | £ | .. | .. | 3 % | 2⅞— 3 | 2¾— 3 | 2 7/8 | .. |
| 49,840 | Do. do. do. 6 % Pref. .. .. .. | £ | .. | .. | .. | 6⅝— 6 | 6¼— 6 | 6⅛ | .. |
| 250,000‡ | Do. do. do. 4 % 1st Mort. Deb. Stock Red | Stock | .. | .. | .. | 99 —101 | 99 —101 | .. | .. |
| 100,000 | Metropolitan Electric Supply, 1 to 100,000 .. .. .. .. .. | 10 | 7½% | 8½% | 10 % | 17⅞— 18½xd | 17½— 18⅜ | 18⅛ | 17⅞ |
| 71,106 | Do. do. 4½% Cum. Pref. 1—71,106, £3 paid .. | £ | .. | .. | .. | 6⅝— 6⅞ | 6¼— 6⅜ | 6 7/8 | 6 11/16 |
| 220,000‡ | Do. do. 4½% 1st Mort. Deb. Stock .. .. | .. | .. | .. | .. | 110 —115 | 109 —114 | 112 | 111½ |
| 960,000‡ | Do. do. 3½% Mort. Deb. Stock Red .. .. | Stock | .. | .. | .. | 97 — 99 | 97 — 99 | .. | .. |
| 250,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. .. .. .. | 100 | .. | .. | .. | 99 —101 | 99 —101 | 100 | .. |
| 10,852 | Notting Hill Electric Lighting .. .. .. .. .. | 10 | 6 % | 6 % | 7 % | 14½— 15½ | 14½— 15½ | .. | .. |
| 59,000 | Do. do. 4% 1st Mort. Deb. .. .. .. | 100 | .. | .. | .. | 102 —104 | 102 —104 xd | .. | .. |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. .. .. .. .. | £ | 14½% | 14½% | 14½% | 13½— 14½ | 13½— 14⅝ | 14 | .. |
| 20,000 | Do. do. do. 7 % Pref. 20,081 to 40,080 | £ | .. | .. | .. | 8¼ — 8⅝ | 8¼— 8⅝ | .. | .. |
| 150,000‡ | Do. do. do. 3½% Deb. Stock Red .. | 100 | .. | .. | .. | 98 —100 | 98 —100 | .. | .. |
| 12,000 | Smithfield Markets Electric Supply, Ord. .. .. .. .. | £ | 2½% | 4 % | .. | 9⅛— 9⅜ | 8⅞— 8⅜ | .. | .. |
| 50,000 | Do. do. do. 4 % Deb. Stock .. .. | Stock | .. | .. | .. | 79 — 83 | 79 — 83 | .. | .. |
| 65,000 | South London Electricity Supply, Ord. .. .. .. .. .. | £ | 1¾% | 3 % | 4 % | 3⅞— 4⅛xd | 3⅝— 4¼ | .. | .. |
| 100,000 | South Metropolitan Electric Light and Power (Ord. .. .. .. | £ | .. | .. | .. | ⅛ — 1 | ⅛— 1 | .. | .. |
| 50,000 | (*Late Blackheath and Greenwich* 7 % Pref. .. .. | £ | .. | .. | .. | 1⅜— 1 7/16xd | 1⅜— 1 7/16 | .. | .. |
| 100,000 | *Dist. E.L.Co.*) 4½% 1st Deb. Stock | 100 | .. | .. | .. | 107 —110 | 105 —108 xd | 107½ | 106 |
| 80,000 | Urban Electric Supply, Ord. .. .. .. .. .. | £ | .. | .. | .. | 5 1/16— 5 3/16 | 4 15/16— 5 1/16xd | 5 1/16 | 4 15/16 |
| 80,000 | Do. do. 5 % Cum. Pref. .. .. .. .. | £ | .. | .. | .. | 5 1/16— 5 3/16 | 5 — 5 1/16xd | 5 3/32 | 5 3/32 |
| 200,000 | Do. do. 4½% 1st Mort. Deb. Stock Red .. .. | 100 | .. | .. | .. | 106 —108 | 104 —106 xd | .. | .. |
| 110,000 | Westminster Electric Supply, Ord. .. .. .. .. .. | £ | 12 % | 13½% | 14% | 12 — 13 | 12 — 13 | 12¼ | 12 |
| 28,141 | Do. do. 5 % Cum. Pref. .. .. .. .. | £ | .. | .. | .. | 6¼— 6½ | 6¼— 6½ | 6 1/16 | .. |

Shares not officially quoted :—Mackay Companies 40—40½

*Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid

## MARKET QUOTATIONS, Wednesday, April 5th.

| | CHEMICALS, &c. | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| *a* | Acid, Hydrochloric .. .. .. per cwt. | 5/- | .. |
| *a* | ,, Nitric .. .. .. .. per cwt. | 22/- | .. |
| *a* | ,, Oxalic .. .. .. .. per cwt. | 82/- | .. |
| *a* | ,, Sulphuric .. .. .. per cwt. | 5/6 | .. |
| *a* | Ammoniac, Sal .. .. .. per cwt. | 42/- | .. |
| *a* | Ammonia, Muriate (crystal) .. per ton | £28 10 | .. |
| *a* | ,, ,, .. .. .. per ton | £20 | .. |
| *a* | Bleaching powder .. .. .. per ton | £5 5 | .. |
| *a* | Bisulphide of Carbon .. .. per ton | £15 | .. |
| *a* | Borax .. .. .. .. .. per ton | £18 | .. |
| *a* | Benzole (90 %) .. .. .. per gal. | 7/- | .. |
| *a* | ,, (50/90 %) .. .. .. per gal. | 5/6 | .. |
| *a* | Copper Sulphate .. .. .. per ton | £23 | .. |
| *a* | Lead, Nitrate .. .. .. per ton | £25 | .. |
| *a* | ,, White Sugar .. .. per ton | £31 | .. |
| *a* | ,, Peroxide .. .. .. per ton | £37 10 | .. |
| *a* | Methylated Spirit .. .. .. per gal. | 2/6 | .. |
| *a* | Naphtha, Solvent (90% a 160° C). per gal. | 5/6 | .. |
| *a* | Potassium Bichromate, in casks per lb. | 8d. | .. |
| *a* | Potash, Caustic (75/80%).. .. per ton | £19 | .. |
| *a* | Potassium Cyanide .. .. per lb. | 7½d. | .. |
| *a* | Shellac .. .. .. .. per cwt. | 165/- | .. |
| *a* | Sulphate of Magnesia .. .. per ton | £4 10 | .. |
| *a* | Sulphur, Sublimed Flowers .. per ton | £6 10 | .. |
| *a* | ,, Recovered .. .. per ton | £5 10 | .. |
| *a* | ,, Lump .. .. .. per ton | £5 | .. |
| *a* | Soda, Caustic (white 70 %) .. per ton | £10 15 | .. |
| *a* | ,, Crystals .. .. .. per ton | £8 | .. |
| | Sodium Bichromate, casks .. per lb. | 9½d. | .. |
| | ,, Cyanide .. .. .. per lb. | 7d. | .. |
| | **METALS, &c.** | | |
| *b* | Aluminium Ingots, in ton lots .. per ton | £180 | .. |
| *b* | ,, Wire, in ton lots .. per ton | £168 | .. |
| *b* | ,, Sheet, in ton lots .. per ton | £166 | .. |
| *b* | Babbitt's metal ingots .. .. per ton | £48 to £140 | .. |
| *c* | Brass (rolled metal 2" to 12") basis per lb. | 7¾d. | .. |
| *c* | ,, Tube (brazed) .. .. per lb. | 9¾d. | .. |
| *c* | ,, ,, (solid drawn).. .. per lb. | 9d. | .. |
| *c* | ,, Wire, basis.. .. .. per lb. | 8d. | .. |
| *c* | Copper Tubes (brazed) .. .. per lb. | 10¼d. | .. |
| *c* | ,, ,, (solid drawn) .. per lb. | 10½d. | .. |
| *g* | Copper Bars (best selected .. per ton | £82 | .. |

| | METALS, &c. (*continued*). | Latest Price. | Fortnight's Dec. or Inc. |
|---|---|---|---|
| *g* | Copper Sheet .. .. .. per ton | £82 | .. |
| *g* | ,, Rod .. .. .. .. per ton | £82 | .. |
| *e* | ,, (Electrolytic) Bars .. per ton | £70 10 | .. |
| *e* | ,, Sheets .. per ton | £87 | .. |
| *e* | ,, ,, Rod .. per ton | £81 | .. |
| *e* | ,, ,, H.C. Wire per lb. | 9¼d. | .. |
| *f* | Ebonite Rod .. .. .. per lb. | 8/8 | .. |
| *f* | ,, Sheet .. .. .. per lb. | 8/- | .. |
| *n* | German Silver Wire .. .. per lb. | 1/6 | .. |
| *h* | Gutta-percha fine .. .. .. per lb. | 6/- to 7/- | .. |
| *h* | India-rubber, Para fine .. .. per lb. | 5/7 | .. |
| *i* | Iron, Charcoal Sheets .. .. per ton | £18 | .. |
| *i* | ,, Pig (Cleveland warrants) per ton | 49/- | 6d. dec. |
| *i* | ,, Forgings, according to size per ton | From £11 | .. |
| *i* | ,, Scrap, heavy .. .. per ton | 47/6 to 50/- | .. |
| *i* | ,, Wire, galvanised No. 8 .. per ton | £9 15 | .. |
| *g* | Lead, English Ingot .. .. per ton | £12 15 to £12 17 6 | 2/6 to 9/- inc. |
| *g* | ,, ,, Sheet .. .. per ton | £14 5 | 5/- inc. |
| *m* | Manganin Wire No. 28 .. .. per lb. | 8/- | .. |
| *g* | Mercury .. .. .. .. per bot. | £7 12 6 | .. |
| *d* | Mica (in original cases) small .. per lb. | 6d. to 1/ | .. |
| *d* | ,, ,, ,, medium per lb. | 2/6 to 4/- | .. |
| *d* | ,, ,, ,, large .. per lb. | 4/6 to 8/6 | .. |
| *p* | Phosphor Bronze, plain castings per lb. | 1/1 to 1/3 | .. |
| *p* | ,, rolled bars & rods per lb. | 1/1 to 1/3 | .. |
| *p* | ,, ,, strip & sheet per lb. | 1/3 | .. |
| *o* | Platinum .. .. .. .. per oz. | £2/6 | .. |
| *e* | Silicium Bronze Wire .. .. per lb. | 10½d. to 11½d. | .. |
| *i* | Steel, Magnet, acc'd'g to desc'p'n per ton | £58 | .. |
| *i* | ,, ,, in bars .. .. | £15 to £40 | .. |
| *g* | Tin, Block .. .. .. .. per ton | £136 to £138 | 10/- to 30/- inc. |
| *n* | ,, Wire, Nos. 1 to 16 .. .. per lb. | 1/7½ | .. |
| *p* | White Anti-friction Metals— "White Ant" brand .. per ton | £48 to £65 | .. |
| *j* | Yarns, 2/10s Grey Cotton, on sp'ls per lb. | 8d. | .. |
| *j* | ,, 6 lea. Flax .. .. .. per lb. | 5¾d. | .. |
| *j* | ,, 8 ply 10 lbs. Russian .. per lb. | 4 13/16d. | .. |
| *j* | ,, 10 lbs. Russian, single .. per lb. | 4¼d. | .. |
| *j* | ,, 180 lbs. Jute rove .. per ton | £11 | .. |
| *k* | Zinc, Sh's (Vieille Montagne bnd.) per ton | £26 17 6 | 10/- dec. |

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co., *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

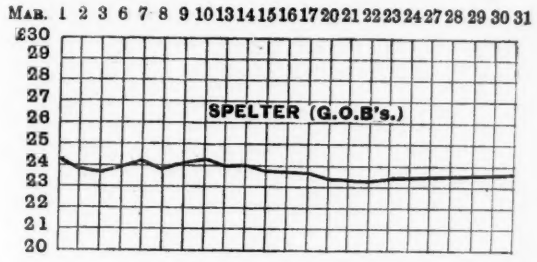
**Standard Specification for Boiler Steel.**—The Engineering Standards Committee recently published their specification for boiler steel for marine boilers. We presume it will also be applicable to land boilers. The steel must be open hearth, but may be either acid or basic, and the finished material must not have been hammer-dressed. Test pieces are, if possible, to retain their rolled surfaces on two opposite sides of the piece, and elongation is to be measured on a length of 8 in. Test pieces are to be treated the same as the material in the matter of annealing. The dimensions of test pieces are stated for material of various thickness. For plates the following tensile strengths are given:—

1. Shell plates, 28 to 32 tons per sq. in.
2. Flange plates and furnaces, 26 to 30 tons per sq. in.

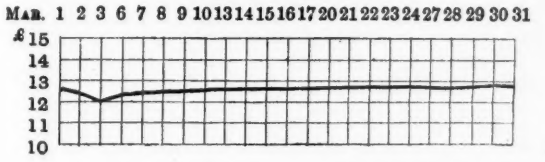
Where tensile strength is unimportant, the bending test alone may be specified. Elongation in 8 in. is specified as 20 per cent. for material 0·375 in. thick of class (1), and not less than 23 per cent. for class (2) of same thickness dimensions. Rules are given for the taking of samples for test purposes. If the maker chooses, a fresh test piece may be taken should a test piece break outside the middle third of its length. This proviso is a safeguard against improper gripping of the test piece in the grip jaws. Cold bends and temper bends are specified, with rules for removing the raw edge or arris formed by shearing. Rules are given for bending and for other matters, such as defacing the brand on a condemned plate. In an appendix are given illustrations of test pieces recommended for plates and other structural materials.

## METAL MARKET.

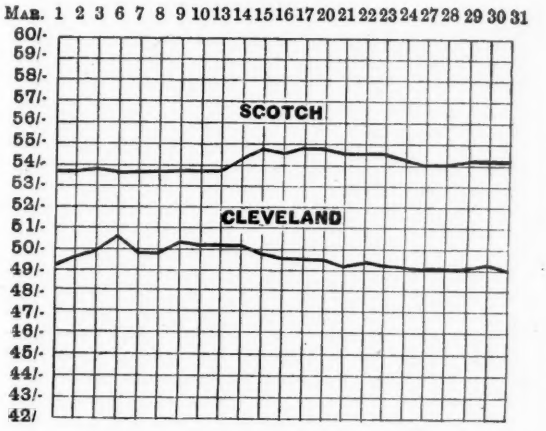
### Fluctuations in March.



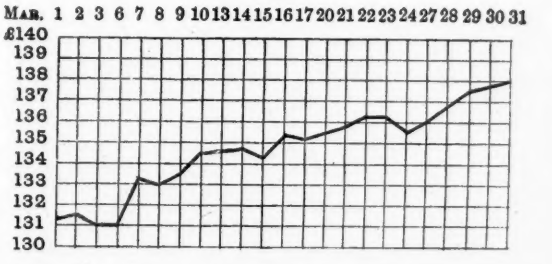

### LEAD (ENGLISH).



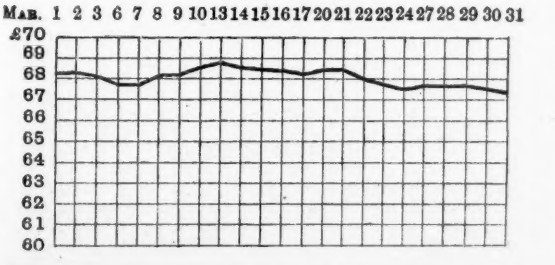

### IRON.




### TIN.




### COPPER (G.M.B's.)




**Cinderella Dance.**—The members of the "Robertson" Electric Lamps Fire Brigade at Brook Green held a Cinderella Dance in the large hall at Brook Green Works on Saturday evening, March 25th, and, judging by the success of the proceedings, it is likely to become an annual function. About 300 friends and visitors were present, taxing to the full the capacity of the excellent hall provided by the firm for the recreation of the employés of the Robertson Electric Lamp Works.

## INSTITUTION OF ELECTRICAL ENGINEERS.

### SOME EFFECTS IN THREE-PHASE WORKING.

On February 27th Dr. W. M. Thornton read a paper on this subject before the Newcastle Local Section of the I.E.E. The paper dealt largely with phenomena observed upon the system of the Newcastle-on-Tyne Electric Supply Co, and a large number of oscillographic curves were taken under working conditions by Mr. H. C. Leake and Mr. W. B. Woodhouse. The author finds that the curves suffer but little distortion due to the capacity of the cables, the latter being of the three-core type, 3 miles in length. The synchronous motor load, however, had a strong influence upon the wave form, producing decided ripples corresponding to the 13th harmonic. By means of the latter, which ran up and down the curves as the engine rotated, the phase-swing between the generator and motor could be observed. In one case this was measured in this way, and amounted to 17° of phase.

The Parsons turbo-alternator gave a very fine sinusoidal curve on open circuit, but on a synchronous motor load the 23rd harmonic was markedly present in the current wave, and was also present in the voltage wave; the 13th harmonic was present in both. The 23rd harmonic was traced to the movement of the magnetic flux across the slots in the armature core, and it was suggested that high order harmonics would be favoured by short air-gaps, and low induction density in the teeth. The effect of high harmonics in increasing the losses, both in the copper and in the dielectric of the cables, was pointed out.

A turbo-alternator on light load was found to give a current wave possessing a very marked 3rd harmonic. This could not have been present had not the neutral points of the generator and motor been earthed. The 3rd harmonic was due to hysteresis, and it was found that there was a strong reaction on the D.C. field excitation under these light load conditions.

Some tests were made whilst running alternators on water load, which showed that the power factor under these conditions was practically unity. At the same time the current wave was flattened, due to the removal of the earth connection in the generator, and the formation of a mesh connection by the water resistance, whereby the 5th harmonic was reversed in phase.

Some remarkable effects due to phase swinging were observed when synchronous motors were running light, and a stroboscopic method was devised whereby both steady and oscillatory phase displacements between machines running in parallel could be observed.

### "EARTHING."

Glasgow Section.

On the 14th ult. a discussion took place on the paper read by Mr. W. W. Lackie on "Earthing."

Mr. J. W. Black said that Mr. Lackie seemed to indicate that it was possible for an earth current of 250 amperes to pass momentarily through a 3 ampere fuse, and that that was the reason why the main fuse frequently blew with an earth fault on a 3-ampere circuit. An earth fault on the live wire was practically a short circuit between the middle wire and the live wire, and they knew that a short-circuit ought to blow one fuse only, if the fuses were properly proportioned. He thought it would be found that "earthed" cast-iron boxes had been used in nearly every case where the main fuse had gone with an earth on a 3-ampere circuit. The branch fuse went off so violently that an arc was formed to the case, and it was this new earth which blew the main fuse. As pointed out by Mr. Lackie, the blowing of the main fuse frequently caused another arc to form in its own box, so blowing the Corporation fuse. If well designed fuse boxes with insulated or preferably non-metallic cases were used, he thought it was practically impossible for an "earth" on a three-ampere branch to do more damage than blow the three-ampere fuse. Mr. Lackie's remarks about the possibility of getting a 500-volt shock from a 250-volt installation brought out very plainly the great danger of using cheap and shoddy branch switches. It was possible to buy tumler switches, the corners of which were guaranteed to become "live" with one week's ordinary use. With all deference to Mr. Lackie, he submitted that his proposal with regard to earthing was not practicable. It was impossible to permanently insulate the metallic sheathing. The job might be insulated at first, but, sooner or later, a plumber ran a pipe over the conduit. Mr. Lackie said that the job would then be no worse than a job carried out under present conditions. But was this so? He proposed to use a resistance to "earth." The bulk of the current, would under this condition, pass to "earth" by the gaspipe or other metal touching the conduit, as its resistance to earth would be much lower than the resistance or earth connections. The electro-magnet arrangement with bell would certainly be useful. He agreed with Mr. Lackie regarding the use of resistance to "earth" for small motors, and he thought the proposal to connect that to the overload release an exceedingly good one. The same would apply to large switches, fuse boxes, &c., in cast-iron cases. He was of opinion that if the metallic sheathing was made electrically continuous throughout and earthed at one or more points, and if the fuse boxes were properly designed and provided with insulated or non-metallic covers, the installation would be perfectly safe. In his opinion the ideal system was some well-designed concentric system with earthed return. Lampholders were the weakest part of the whole installation, as it was impossible to get the proper space for 250 volts in the standard holder, and insulating the lampholder did not always meet the case.

Mr. George Stevenson said steel-armoured cable was largely used for ship lighting, the armouring being lightly insulated with a layer of tarred jute, and, in his opinion, if proper care was taken this made a much better job than any conduit system when they came to consider power circuits. If Mr. Lackie's proposals were adopted, it would be necessary in many cases where the motors were mounted direct on metal framework making a good earth, to insulate the motor frame from the base plate, and that, in his opinion, constituted an objection. He had some 10 500-volt motors and 100 kw. generator connected to concentric cables with the outer earthed, and as the machine frames were also earthed, the insulation was subjected to the full pressure of 500 volts. The troubles he had encountered had invariably occurred in the starters and fuses, more especially in the latter. A fuse at a reasonable price, which would stand a dead short under the above conditions, was not obtainable at the present time. There were several "patent" fuses which would, no doubt, break a "short," but a good circuit breaker could be obtained for the same money, and, in his opinion, was a more satisfactory article. It was generally agreed that all starters should be earthed also, but he did not think there was a single make of switch on the market which would stand this treatment.

Mr. David McGibbon remarked that an installation in tubing, well bonded and earthed, was the perfect system for the prevention of fires in buildings from electric leakage. Earthing to a water-pipe was a very risky and unfinished system. He would propose that the Corporation run an earth wire into each building along with their service. He did not agree with Mr. Lackie in the hope that engineers would do all they could to stop the use of gas and gas-pipes in buildings where electric lighting or power was being installed. There was so very little heat from electrical apparatus, that gas fires were necessary, so they should meet the difficulty boldly. To put a resistance in the earth circuit in a building where there were also gas-pipes (of less resistance) would increase the danger of fire. All tubing should be earthed as much as possible all along.

Mr. Mavor said that everything possible should be done to ensure continuity of supply, and three insulated wires on a three-wire system ensured this a hundred times better than one with an earthed neutral.

Mr. Allan Arthur said that one disadvantage of having only one earth in a large building was that, in the event of the earth wire being broken, the whole containing system was insulated from earth or only connected to earth by accident. Another disadvantage was that, if the earthing was in the basement and a fault occurred in the top flat, all the tubing to the earth was momentarily alive until the current passing through it blew the fuses, whereas, if there was an earth on every flat, only a small portion of that current would travel along the tube, while the most of it would go right to earth on the top flat. He would be glad if the Corporation passed a rule that the sheathing must be insulated before earthing, because it would ensure increased care on the part of the contractor.

Mr. James Johnstone said that it was a common occurrence to find earths on private installations, which were traced in nine cases out of 10 to outside fittings with uninsulated lampholders, or to lead-covered wiring with metal fittings, in green houses. As for Mr. Lackie's suggestion of a resistance in the earth circuit; if it could be assured that the system carried out on an insulated base was always in that condition, then there would be no question from the consumers, and the supply point of view as to its utility and safety, but what guarantee had they that a plumber would not come along and earth the whole system, apart from the earth circuit with its resistance?

Mr. Lackie, in reply, said that nearly everyone agreed and all fire insurance companies insisted on the metal sheathing being kept clear of gas pipes, and what electrical difference was there between a sheathing being in contact with a gas pipe and its being in contact with an iron girder with which a gas pipe was in contact. He would say none. He did not agree with Mr. McGibbon that the electricity would flow to earth by the easiest road. It would flow to earth by each road in proportion to its resistance. He was inclined to agree with that gentleman, however, that earthing should be *vid* the cable sheathing and not by other metal work, and that an earth plate should be sunk for each installation. But he did not see that the Corporation should be put to the expense of running an earth wire throughout the city for this purpose. The proposal in the paper would make it possible to test whether the tubing was clear of all other earths and continuous, and what he wished was to make the tubing its own earth inside the premises without using earths that were not put there for the purpose of conveying currents. He agreed that the present earthing arrangement was too crude and too violent in its results, and it was partly this which brought the subject to his notice. The proper party to make minute and careful inspection and tests, was the insurance company who were paid for doing so, but did practically nothing for this part of their premiums. These remarks did not apply to the British Engine Boiler and Electrical Insurance Co., who were doing splendid work, and examined installations insured by them periodically, just as they inspected and tested boilers. Mr. Johnstone's warning about joining the earth wire to the street side of the water supply had been given effect to in the new issue of rules by the electricity department. Mr. Black doubted the blowing of the two fuses of different sizes in series on a dead earth. Theoretically the two curves should not touch, but practically they did for three reasons—(1) A three-ampere fuse had a shorter break, and consequently the terminals affected the fusing time; (2) the relative radiating surface of the three-ampere fuse was much greater than in the case of the 25-ampere fuse; (3) the main fuse was probably slightly warm, and so had got ahead, as it were, of the branch fuse which was cold. The distance between the terminals of a fuse and the side of an earthed metal box should be on a 250-volt fuse, the same as the distance between the terminals, and in a 500-volt box, half the distance. Mr. Black said it was impossible to insulate permanently the metallic sheathing. It was, however, possible, he would not say to insulate, but to keep it away from other earth connections, and, further, to test from time to time, and see that its isolation was permanent. For many years a firm in Glasgow did insulate the metal tubes The electrical contractors had learned by experience to keep clear of gas-pipes, and it was now time the plumber was taught to keep clear of sheathing or pipes containing electricity conductors.

*(To be concluded.)*

## A PRIVATE LIGHTING AND POWER PLANT.

Some notes on this subject were read before the Dublin Local Section, on February 9th, by Mr. P. T. Blisset. The generating plant comprises both Willans single-acting engines, coupled to Mather & Platt dynamos, and Parsons turbo-generators. The installation has grown up by degrees, so that the units are of small size, and some exhaust to condenser, some to atmosphere, and some to a steam heating main with a back pressure of 11 lb. per sq in. The wiring of the factory was originally carried out with armoured cables fixed under cleats, but much of this has been put into wood casing. Iron tubes have also been used, but the author thinks the draw-in system exists more in theory than anywhere else. The importance of ready access to all connections is emphasised, and many little troubles are pointed out. Switch fuses with bollow porcelain handles are preferred by the author, but must be lined with asbestos, as otherwise, when one is replacing a fuse with a short on the line, the arc formed may burst the handle with disastrous results.

Low speed motors are advocated by the author, who has 204 under his charge, mostly enclosed and coupled direct The total horse-power is 1,363, but there are rarely more than two or three armatures under repair, and a breakdown causes but little delay. Two pressures are used, 420 and 210 volts, with balancers.

The starting gear is far more troublesome than the motors, and a variety of defects are mentioned as having been discovered in their construction and working.

Circuit breakers are too apt to come out on small provocation and have been replaced by fuses.

Perhaps no feature of the author's notes is more remarkable than his experience with tubing and concentric wiring systems. Moisture collected in pockets in brazed steel conduit; enamelled tube rusted through in less than two years; the draw-in system was impracticable with heavy wires; tubing fastened to girders was apt to get loose and the ends then cut the insulation; concentric wiring proved a failure, as many as six or eight faults occurring in a length of 1 ft.; watertight distribution boxes got filled with water (!), which boiled and blew fuses. Heavy pitch-pine casing, fixed by carpenters, has been successful in fairly dry situations, and the cleat system is also good and safe. Porcelain fittings for this work are wanting.

Groups of incandescent lamps have been found more economical than arc lamps for works interiors.

## THE STEAM ENGINE RESEARCH COMMITTEE.

The Steam Engine Research Committee of the Institution of Mechanical Engineers has, after a period of five years of research, presented its first report in the form of a paper by Prof. D. S Capper, who has apparently done all the work. The original object of research was initial cylinder condensation, but the learned professor's arduous labours appear to have been directed perhaps more to valve and piston leakage than to the supposed main object, which was to find the effect of steam jacketing at various temperatures and speeds upon cylinder condensation.

The report contains evidence of an immense amount of labour and a large expenditure of time and energy upon a number of what we cannot but feel are rather useless tests. Nothing is said of the sort of steam used in the jackets, and therefore it is to be presumed that the steam was simply at boiler pressure and temperature. There is nothing to tell us whether the jackets really contained steam or air or water. A jacket cannot be expected to be of any serious value unless it is fed with steam from a separate boiler at a higher pressure and temperature than the main boilers. Such a boiler should discharge its steam, preferably superheated considerably, through the jacket and through a reducing valve into the main boilers. The whole of the steam of the special boiler should pass through the jackets, effectually sweeping them free of air and giving a head of temperature on the outside of the working barrel to force heat through this into the cylinder. Yet five long years have been expended in trials of a miserable 6-in. cylinder slide valve engine, that represents a phase of steam practice that ought to be, if it is not, as extinct as the dodo. The sense of proportion, or rather the lack of such sense, has never been more apparent than in the Committee's labours, which are a painful evidence of the inefficiency to which our great technical societies may become reduced.

There is nothing whatever to tell us whether any attempt was ever made to make the valve of this little sorely tried engine steam-tight. That it was not steam-tight is only too clear from the report. Was it even attempted to make it tight, when as hot as the steam, by any system of grinding in place? Nothing is

said on this. Yet when a learned professor sets out to claim cylinder condensation to be of small account in comparison with valve leakage, it might have been thought that he would have taken care that his valves were not abnormally out of order. Hirn, who did so much in the way of explaining cylinder condensation, is pushed aside by the Callendar-Nicolson school, to which Prof. Capper appears to give his adherence, and we are asked nowadays to put down everything to valve leakage, and practically to ignore the interchange of heat between the cylinder metal and the moist steam within it. No satisfactory explanation of valve leakage appears to be attempted. Is it not most probably an effect of capillarity? Water obtains entrance in the minute capillary space between valve and seat. The valve rides on a film of water, and at the peripheries at lower pressure this film evaporates and disappears; a constant stream of water thus creeps through the opening, and is assisted in doing so by valve movement. But the pity of it all is that even the leakage theorists admit that leakage is a function of wet steam, and that it is practically non-existent where steam is dry and valve faces are reasonably level.

If there is anything in modern steam engineering that is a certainty, it is that superheating produces economy if it is rationally carried out. Superheating reduces leakage, and it also reduces cylinder condensation. On this ground, therefore, it seems to matter very little whether the steam that disappears in the early stages of the stroke is leakage or is condensation, for both evils are cured by superheat. The usefulness of the research is, therefore, about on a par with a research into the losses of the Newcomen engine, due to the use of the cylinder as a jet condenser. Watt, we know, invented the separate condenser to avoid the losses of the jet condenser cylinder. A very fine paper might, to-day, be written on the thermal losses of the Newcomen engine; but would it be of much service in establishing the Watt principle more firmly? It might not suit the leakage theorists of to-day, for Watt's arguments are just what they do not seem to relish. The first report of the Steam Engine Research Committee appeals to us as a deplorable waste of energy. As one of the speakers said, in the course of the discussion, it is doubtful whether any engine designer will obtain the slightest assistance from the report. We think that the engine was too small for a fair test, that some of the more important data are insufficiently detailed, and that the very matter of the research is practically out of date.

Heat applied outside the working barrel of a steam engine is not, and cannot be, so efficient as heat applied on the inside or working side of the barrel. We understand that the archives of the Institution contain the reports of another committee on the steam engine which have not been published, and were even unknown to one of the members of the Council itself, who complained that the committee had furnished no information, and was corrected by another member of council, who had been on the particular committee, and stated that work of great value had been done, but not published. It were a pity in that case that the really useful report had not been allotted the costs of publication in preference to the present report, which will be of no practical commercial value.

## PHYSICAL SOCIETY.

At the meeting held on March 24th, Prof. J. H. Poynting, F.R.S., President, in the chair, Mr. W. C. Clinton read a "Note on the Voltage Ratios of an Inverted Rotary Converter." In this note terms due to the effect of armature resistance are introduced into the ordinary theoretical equations. The resultant voltage on the A.C. side is found to be less than that given by the usual rule.

A paper "On the Flux of Light from the Electric Arc with varying Power Supply," was read by Mr. G B. Dyke. The paper records the results of experiments made on the electric arc with the following objects:—(1) To obtain a series of curves for alternating and continuous arcs of different lengths, showing the relation between the mean spherical candle-power and the power supplied to the arc. (2) To compare the efficiencies of the alternating and continuous arcs under different conditions of arc length and power supply. The frequency of the alternating current was 80 cycles. For normal arc lengths the A.C. efficiency is about $\frac{2}{3}$ of the D.C. efficiency.

A paper "On the Application of the Cymometer to the Measurement of Co-Efficiencies of Coupling of Oscillation Transformers" was read by Dr. J. A. Fleming. This paper deals first with the latest pattern of instrument, called by the author a cymometer, designed for the measurement of the frequency of electric oscillations, and also the length of long electric waves.

It consists of a sliding tubular condenser, consisting of two brass tubes, separated by a thin ebonite tube, the outer tube being capable of sliding off the inner tube. Parallel with this sliding condenser is placed an inductance coil or helix, of bare copper wire, wound on an ebonite tube. The outer brass tube of the sliding condenser carries a collar, which in turn carries a rod with a crutch at the end resting upon the inductance coil. The circuit of the instrument is completed by a copper bar, which joins one end of the inductance coil with the inner surface of the sliding condenser. When the outer tube of the condenser is moved by an insulating handle, the same motion reduces equally the capacity of the condenser and the portion of the inductance coil included in the closed circuit. The circuit, therefore, consists of a variable capacity and inductance in series. The author calls the square root of the product of the capacity and inductance in any position the *oscillation constant* of the instrument. A scale is provided parallel with the inductance coil, on which is engraved the oscillation constant and the corresponding frequencies connected therewith by the formula

$$n = 1/2\pi\sqrt{CL}$$

In addition to this, the instrument is provided with a vacuum tube, preferably a Neon vacuum, which is connected between the inner and outer surfaces of the condenser. The instrument is used in the following manner:—

The copper bar is placed parallel and near to a circuit in which oscillations are taking place, and the handle of the instrument is moved, thus varying the oscillation constant, until the vacuum tube glows most brightly. Under these circumstances, it is known that the circuit of the cymometer is in resonance with that of the circuit being tested, and their oscillation constants are therefore the same, hence the scale reading gives the product of the capacity and inductance of the circuit being tested. The instrument is also provided with a rectangular wire circuit, the inductance of which is known. If this circuit is joined up with any unknown capacity and oscillations are set up in it, the cymometer can be used as above to determine the product of capacity and inductance in the circuit being tested, and the inductance being known, the capacity is therefore known also. Again, we can find the coefficient of coupling of an oscillation transformer. The inductance of any circuit can be ascertained for high frequency currents by the cymometer. The instrument can be used for measuring the oscillation constant or the frequency in an open oscillating circuit, such as that of a wireless telegraph aerial, and by means of it the wave-length which is being sent out from the aerial can be measured, and also the wave-length of waves being received on any aerial. The instrument can also be employed to analyse a compound oscillation taking place in a circuit and determine the compound frequencies. It thus acts as an electrical equivalent of a spectroscope.

## ELECTRIC RAILWAYS IN GERMANY.

In a country like Germany, where practically all the railways are owned by the different States which constitute the empire, it is an extremely difficult matter to induce any of the Governments to make a radical departure from the present methods of steam locomotion. This is not due to any want of appreciation of modern systems of dealing with traffic, but rather to the disinclination on the part of the official mind to do anything that would tend to introduce the element of private competition with the State railways. Hence it happens that with the exception of the capital, electric traction on the railways makes comparatively little progress in that country, notwithstanding the many schemes which are reported from time to time as emanating from private promoters. In these circumstances it is interesting to record the fact that the Prussian State railway authorities, who have frequently been urged by the principal electrical companies to substitute electric for steam locomotion on the railways, or to grant concessions for the construction of high-speed lines, have at last decided to make an experiment on their own account in the vicinity of Hamburg. This decision may, perhaps, have been dictated by the results attained on the Anhalt suburban electric railway on the direct-current system in Berlin, which was taken over by the Prussian railway authorities a few months ago, together with the single-phase alternating 6,000-volt system used on the Spindlersfeld-Johannisthal Railway, and also by the well-known high-speed trials on the military railway between Marienfeld and Zossen. The Government scheme does not relate to the project which has been under discussion for a number of years for the construction of a network of city and suburban electric railways in Hamburg, and which is jointly promoted by the Siemens & Halske Co. and the Allgemeine Co., of Berlin. It concerns four main lines of a total length of nearly 17 miles, namely, (1) the Hamburg—Altona connecting line; (2) Altona—Blankenese; (3) Hamburg—Hasselbrock; and (4) the new suburban line between Hasselbrock, Barmbeck and Ohlsdorf. An agreement for the conversion of these railways has been concluded between the Prussian State Railway authorities and the Hamburg Senate, and the scheme now only requires the endorsement of the Prussian Diet in order to be carried into effect at an early date. The expenditure is to be provided partly by the State of Hamburg and partly by that of Prussia. It is proposed to erect a generating station near Altona, and the names of the prospective contractors are given as the Allgemeine Co., the Siemens & Halske Co. and the Lahmeyer Electricity Co.

The proposal in regard to Hamburg and vicinity is apparently to be proceeded with, as the consent of the Prussian Diet is not expected to be withheld, as a joint enterprise of the two States. In other provincial cases, however, private initiative is endeavouring to obtain a footing. Among these may be cited the scheme for the establishment of an electric railway between the centre of Cologne and the heart of the metallurgical town of Düsseldorf, a distance of nearly 25 miles. This project, which is promoted by the Allgemeine Co. and the Siemens-Schuckert Works Co., contemplates an expenditure of £1,100,000, and a speed of from 9 to 11 miles an hour in the towns, whilst a rate of 45 miles an hour is proposed for the intervening route. The promoters do not anticipate any return on the capital outlay at first, although an excellent yield is expected after the line has been in operation for a period of six years. The scheme is now under the consideration of the local authorities concerned, but the principal point relates to the attitude of the Railway Minister. So far, the latter is said to be favourably disposed towards the projected railway; indeed, his disposition is such that exceptional rights of State expropriation are said to be

entertained in the event of a concession being granted for the building of the line. Another scheme proposes the construction of a railway between Mannheim and Durkheim, and a company is to be formed for the purpose of carrying out the proposal, which represents a total length of 15 miles. It is understood that the municipal authorities of the two towns in question are in agreement, but those of Ludwigshafen, which is the most important intervening town, have not yet given definite adhesion.

In Berlin—the home of so many electric railway projects, and at present the locale of a legal dispute between the Grand Berlin Tramways Co. and the City Council as to the right of concessioning underground lines along the route followed by tramways on the surface—there is apparently no intention of making the mistake incidental to London. The Berlin city councillors appreciate the value of the only underground electric railway in the capital; they know that it removes a considerable number of passenger vehicles from the surface of the streets, and to this extent relieves the congestion on the surface. They do not wish to draw—as in the south of London—passengers from an underground service in order that they may be carried above ground, and thus restore the congestion by the blocking of streets owing to any increase in the number of tramcars. No, the Berlin City Council believe that the greater the amount of traffic that is led underground, the greater will be the relief afforded on the surface. This contention is illustrated by the fact that from their actions both the Berlin and the suburban authorities are convinced that the problem of rapid transit, and of preventing the streets from becoming a mere accumulation or solid block of vehicles of all kinds, can only be satisfactorily solved by permitting the passenger traffic to be handled below or above the street surface as far as possible. In the case of the City Council, a scheme has been prepared for an underground line between the extreme north and the south. The expenditure is estimated at £3 000,000, but in non-official circles it is thought that the outlay would be higher, in order to connect Wedding with Rixdorf as desired. As to the question of overhead lines, the Rummelsberg authorities have in contemplation an elevated railway in preference to a tramway; a syndicate is promoting an express line between Berlin and Schmockwitz, in which the local authorities are also to be financially interested to the extent of 70 per cent. of the capital expenditure; and the proposed high-level line between Berlin and Reinickendorf and Dalldorf—Tegel is progressing; whilst the extension of the existing underground railway from Potsdam Platz to Spittelmarkt is awaiting the decision of the Courts in the before-mentioned action as to tramways *versus* railways.

In conclusion, a few figures may be given as to the "taxes" paid by transport companies to the Berlin City Council during 1904, the total exceeding £126,900 Of this amount the Grand Berlin Tramway Co. and its associated concerns were responsible for £120,000, this including £16,940 as participation in the profits and £1,057 as compensation for consent to the abolition of battery cars! The Underground and Elevated Electric Railway Co. had to pay £3,514, and the Berlin and Treptow Tramway Co. the sum of £3,176, the balance being formed of a contribution by the Continental Co. in respect of the Hohen Schonhausen line.

## REVIEW.

*Light Energy: Its Physics, Physiological Action and Therapeutic Applications.* By Margaret A. Cleaves, M.D. Rebman Co., New York, and Rebman, Ltd., Shaftesbury Avenue, W.C. 1904. Price, cloth, £1 1s.

This is a book that was wanted, and its arrival should be warmly welcomed. Not only does it treat of light, but it treats of it with "light and leading." Covering as it does more than 800 royal octavo pages, it may, to our insular eyes, appear rather colossal in its proportions; but it deals, be it remembered, with a wide subject, and comes from a country of "big things," a country where, this very volume informs us, the sun has the brilliancy of fifteen hundred and twenty-five billions of billions of candles, and where light travels at the rate of thirty thousand millions of centimetres a second. Compared with the latter, how paltry must appear our old-fashioned reckonings in mere miles. Some explanation of its bulk will be found in the fact that not only does it cover a great extent of ground, but it is concerned with a matter which, in many of its aspects, is new. The therapeutics of light have only lately attracted serious attention, and the subject cannot yet be said to have crystallised into recognised shape or shrunk into its permanent proportions. In point of fact, the writer is confronted with a series of problems which are, many of them, enunciated for the first time, and most of them still await solution. Moreover, it is by no means an easy task to collect and condense and put into readable shape, as this book does, a mass of scattered literature much more remarkable for its bulk than for its excellence. Still, making allowance for all this, and keeping his eyes open to the undoubted merits of the volume before him, the reader will find it difficult to resist the impression that a certain amount of judicious pruning and compression would have added crispness to its style, lucidity to its language, and edge to its arguments. But this is a comparatively unimportant point, and the student will not feel disposed to pick holes in a work which is likely to serve him so well. A less trivial matter than this, and one that cannot be passed over quite so lightly, is the appearance of one or two glaring and inexplicable inaccuracies which seriously disfigure its interesting pages, and which all but the captious critic will attribute to imperfect—very imperfect—revision. To find an example of this, the reader need not go beyond the first page of the first chapter, where he will read as follows:—"The various manifestations of energy known as sound, heat, light, electricity and chemical action, are all vibrations of this universal homogeneous incompressible continuous body which is incapable of being resolved into simpler elements or atoms."

As its preface tells us, its pages are devoted to the physics, physiological action and therapeutic effect of light energy from both natural and artificial sources, and it by no means limits itself to the phenomena of the visible spectrum. The energy of light, and its manifestations, are first explained, and then the elementary physics of heat, discharges in vacuo, visible light, ultra-violet rays, N-rays, X-rays, cathode rays, alpha, beta, and gamma rays. The reader will be relieved to find that anything like a full consideration of the X-ray has been judiciously avoided; it is appalling to think of the dimensions which such a book might have attained had this subject been discussed in detail.

After 150 pages devoted to the physics of light, its "action on elementary forms of life and vegetable organisms" is considered at some length, the summary of this chapter being as follows:—"Vegetable life is not possible save in the presence of light. Chlorophyll assimilation, the fundamental phenomenon of plant life, is only possible in the presence of the energy of light. The frequencies of the spectrum influencing this function are the red, orange, and the violet . . . . In connection with geotropism, it rules the direction of the growth of the stem, the leaves, their position, the position of the flowers, in short, it determines some actual movements of the three parts of the plant. In the production of all these phenomena, the chemical part of the spectrum is alone active."

The chapter on the action of light on bacteria concludes as follows:—"Thus the chemical activities of light serve in hygiene, sanitation, and also in disease:—In the one instance to maintain health, in the other to disinfect or destroy pathogenic organisms, and to check the inroads of disease by increasing not only the red blood supply, but the white as well, and the functional activity of the whole organism."

The biological action of light is thus summed up:—"That light energy has an action upon the living organism is shown:—(1) By its evident effect upon the skin, intense light producing inflammation. (2) By its action upon the sweat glands promoting perspiration; this is true of chemical light energy as well as of thermal. (3) By its direct action upon the blood and the blood vessels, dilatation. (4) By exposure of large superficial areas of the body to the action of intense light energy, there results an increased amount of blood in the superficial vessels, and a depletion of the internal organs or viscera. (5) By a direct or indirect influence, light energy modifies a transmutation of matter. (6) By the action of light energy in relation to motor excitation. (7) By its parasiticidal power. (8) An excess of light stimulus—in common with too great an expenditure of any energy—is destructive and paralysing; by it dermatitis, a prolonged erythema with tendency to recurrence and insolation are produced" (p. 306).

Speaking of sun baths, it is explained that all those physiological changes which are included under the action of light take place. The influence of the sun bath is due to a complex of all the frequencies of the spectrum. Thermal energy gives rise to an increase in the bodily temperature, and thermic reaction stimulates the heart, brain, and other organs, and there is an increase in metabolic activity; the thermal effects are unaccompanied by the depressing effect so often experienced by the use of hot air, water, or vapour. This is to be attributed to the

chemically active light energy conjointly active with the thermal. The primary effect of the sun bath in diseases due to bacteria, is not one of bacterial destruction but one of increased physiological resistance. In connection with this point it is stated that the premature falling out of hair is sometimes prevented by the exposure of the unprotected head to the sunlight. The good effect is produced in two ways:—(1) By the direct action of light on the skin, and (2) by the absence of the accustomed pressure of the hat interfering as it does with the circulation.

In treating of the electric arc bath, the author is truly on her own ground, having employed it in her practice for about a dozen years. The conclusions arrived at are that the "non-concentrated light energy of the carbon electric arc has been found of great value in both primary and secondary anæmias, malnutrition, neurasthenia, neuritis, neuralgias, tuberculosis of the bowels, sprains and contusions, eczema, seborrhœic eczema with loss of hair, psoriasis and acne, as well as in respiratory diseases. In no one condition is it of greater value than in tuberculosis of the lungs."

With reference to the incandescent light bath, the therapeutic effects are thus given: (1) A profound action on the vaso-dilators of the arteries. In this way the heart is relieved and the constriction to the arterial and capillary circulation is lessened; there ensues diminution of arterial pressure. A further effect is the diminution of nerve irritation. (2) A revulsive effect by the dilatation of the cutaneous vessels, the blood is diverted to the skin, the "peripheral heart." (3) Action upon the sweat glands. (4) Increased oxidation. It is explained that about the same time Kellogg in America, and Hedley in England, introduced their respective systems, that of the former being a cabinet filled with ordinary incandescent lamps, that of Hedley consisting of incandescent lamps each carrying 2½ amperes of current fixed in reflectors. This latter apparatus has been in use ever since, and is known as the Dowsing radiant heat bath.

Although both the ordinary incandescent light cabinet and the so-called radiant heat bath serve similar therapeutic indications at the lower temperatures, it must be noted that the device of Hedley commands a much higher range of temperature than cabinets filled with ordinary electric lighting lamps, and it thereby secures a very powerful counter-irritant, roasting, or "mustard plaster effect," which, extending over a large surface, is found to be serviceable for certain purposes which a mere sweating effect does not secure. This latter point does not seem to be brought out quite clearly by the writer of the book under notice.

The concentrated energy of the visible chemical frequencies of the solar spectrum is next considered, and some evidence adduced of its useful employment (by means of mirrors) in the treatment of tuberculosis, malignant pustular carbuncle, pneumonia, chorea, neuralgia, &c. Next comes "the concentrated energy of the electric arc light in skin diseases," and the oft-quoted opinion of Finsen is referred to that not more than two per cent. of tubercular lupus can be regarded as incurable. For this purpose a beam of light is available, rich in a complex of all the frequencies from the blue up to the ultra-violet, which is at once both bactericidal, and capable of exciting tissue reaction. *A propos* of this, the author has something to say of the iron electrode lamp. With such a lamp of 25 amperes, Bang states that a surface culture of staphylococcus was killed in a few seconds, whilst with an ordinary carbon arc the same number of minutes was required. But the former has its disadvantages. The light energy from a carbon arc has, according to Bang, a penetrating power three times as great as an iron arc of the same amperage. Moreover, although the iron is rich in ultra-violet frequencies, these are very readily absorbed by the majority of media.

The field of usefulness of the iron lamp is, therefore, limited. For the treatment of lupus the Finsen apparatus has maintained its supremacy. Other diseases, such as eczema, acne, epithelioma, alopæcia, vascular nœvus, tubercular joints, vegetable parasitic diseases (such as ringworm) are often amenable to this treatment. It is not considered "that the curative action of light energy is due to bactericidal action *per se*." The micro-organism, *e.g.*, the tubercle bacillus, disappears not because it is killed, but because the physiological resistance of the individual is increased by the action of light upon the blood, and secondly, because "the same oscillating swing of the corpuscles of the chemical frequencies of light energy which, in the one instance, stimulates physiological processes, in the other serves to inhibit their action."

The concentrated action of incandescent light energy is compared with that of the sun and electric arc, it being pointed out that, in chemically active frequencies, both the two last-named are much richer both as to blue-violet and ultra-violet. Such violet frequencies above 30 micro-centimetres in length as incandescent light may produce are of no therapeutic value, as they do not penetrate the glass. The author considers that in the local incandescent bath a temperature of 212° F. can be "readily borne." The writer of this review has not any accurate experiments to put forward on this subject, but he ventures to doubt the correctness of the statement. In such baths, a perhaps unintentional fraud may be perpetrated upon the patient who fails to remember that the thermometer is often placed much nearer the source of heat than is the patient's skin.

As to the action of blue light, it is summed up in Kaiser's conclusions, which are as follows:—(1) Blue light occasionally stimulates metabolism: (2) the action is mainly due to the more refrangible rays; (3) it is directly proportional to the distance and intensity of the rays of light; (4) blue rays penetrate vascular tissue easily; (5) they have a strong absorbent and anodyne effect.

Stress is laid upon the usefulness of red light in the treatment of smallpox. *A propos* of this, Bayle notes that at the Maison Lumière, where photographic plates are prepared, and which was formerly lighted by a red light, is now lighted by a green one, the change being made because of the intense cerebral excitation on the part of the workman produced by the red. When green was substituted this ceased at once. It is suggested that green be substituted also in the treatment of smallpox.

After pointing out that "N"-rays are not accepted by physicists as an undoubted scientific fact, the following method (of Charpentier) is given as the most simple of observing these rays when they are produced from the living body:—"Place on a black card a layer of collodion for adhesive purposes, and then cover it with a quantity of phosphorescent sulphide spread out so as to form a spot 2 cm. in breadth. This should then be exposed to sunlight, and observed in a place more or less dark.

The card thus prepared must be regarded with an indirect vision. According to Bichat, "N"-rays pass easily through aluminium, black paper, wood and saline water. They are capable of being reflected, and have the properties of refraction, interference and polarisation.

Radium is fully considered. In speaking of its photographic power, it is explained that the effective rays are the beta and gamma group. Unlike the X-rays, there is no difference in transparency between the flesh and the bones in the shadows thrown. Induced radio-activity is not due to transfer of radio-active particles (Curie). Prof. J. J. Thomson found that the radiant gas in Cambridge tap-water possessed properties similar to the emanations of radium. Prof. Greet considers that nothing in aid of the blind is to be expected from radium, and this opinion is fully endorsed by the author.

One of the most interesting chapters in the book is that on fluorescence and fluorescent stimulation. The author adopts the term "sensitisation," and in this connection, finds an analogy in Vogel's discoveries in photography, whereby he succeeded in producing plates which were as readily influenced by red and yellow frequencies as by those of greater refrangibility. It seems reasonable to suppose that fluorescent substances should act as radiant energy transformers, and in so doing impart healthful stimulation. This is true of quinine in malaria. The normal fluorescence of the blood is absent in this disease. The method of sensitisation, *i.e.*, using fluorescent substances internally, and then stimulating by the action of X-rays or radium, has been used extensively by Dr. Morton, of New York, in malignant disease, but the writer of the present book does not think the method shows better results than X-ray used alone.

The book concludes with the "Pathological Effect of Electric Lighting." In the incandescent lamp, mercury vapour lamp, and electric arc, the chemical as well as the

optical intensity is considerable. In the first the visible chemical frequencies, in the last the chemical frequencies, both visible and invisible are present. Basing his conclusions upon the evidence of fatigue as indicated by the closure of the lids, a Russian observer (*Phil. Medical Journal*) decided that electric light is the *least* injurious. The eyes would close per minute with different illuminations as follows:—

| | | | |
|---|---|---|---|
| Candle light... ... | 63 | Sunlight ... | 22 |
| Gaslight ... ... | 28 | Electric light ... | 18 |

On the other hand, a number of eminent oculists in London (see *Electrical Engineer*) agreed that the exposure of uncovered electric lights in the streets and shops was a means of very great danger to the eyesight of the population. Electric light conjunctivitis is then discussed, and the author considers it due to the influence upon the vascular centres, not to direct injury "as there is an interval of quiescence after the immediate results have passed before the acute symptoms come on." Ultra-voilet ray burns of the eye are illustrated by three cases described by Dr. Calcord, of Clariton, Penn. An arc of 250 volts pressure was used to melt a 6-in. hole through a 3-ft. pig-iron plate. This was accomplished in eight hours. Three of the workmen suffered injury to the eyes, and as they stood 10 to 15 ft. away it was believed to be due not to the heat but to the ultra-violet rays of the arc. The symptoms were as follows:—Six hours after exposure there was dimness of vision, swelling of eyelids, puffing and congestion of conjunctiva, marked photophobia and lachrymation with great pain in eyeballs. The symptoms increased in severity for two or three hours, gradually subsiding in 24 hours, all except the dimness of vision, which lasted for two weeks. So far as treatment is concerned, the greatest relief was obtained from application of cold sweet cream from cow's milk, and from cold compress of boric solution. Calcord remarks with reference to these cases that the pain and burning was out of all proportion to visible signs of inflammation, that there was failure of the remedies used in an ordinary burn of the eye, and a well-marked tendency to rapid and complete recovery. Altogether, the author considers that the electric light is too chemically active for the maintenance of the best ocular and optical conditions.

## LABOUR-SAVING MACHINERY IN CENTRAL STATIONS.

[COMMUNICATED.]

One of the most striking differences between the arrangement of the modern central station, as compared with that of the earlier period of development is the extent to which mechanical means of labour have superseded manual methods of performing the various operations in the generation of electrical energy. It is to be feared, however, that while this tendency undoubtedly marks a great advance, it may be, and frequently is, the cause of the installation of labour-saving machinery under conditions where it cannot possibly be sufficiently remunerative to attain the economy expected from its adoption and to justify the expenditure of capital upon it. It may be suggested in this connection that economy is not the sole object in view in making the decision for the wholesale adoption of mechanical labour so frequently met with, and in very many cases there can be not the slightest doubt that this contention is true, economy having been obviously sacrificed to appearances and other æsthetic considerations.

A feeling of pride in possessing or controlling a station, which embodies the most up-to-date principles in its construction, and which can thus be considered to be well in the van of progress, has been a strong influence at work in the choice of such apparatus, to the neglect of careful calculation, with the sole object of financial saving.

It is here submitted that the present-day conditions of the electrical industry, and the sternness of the fight in which it is engaged, against older and longer established means of power supply, demand that utility and economy should be the primary if not the only standpoint from which such matters are judged. In proportion as they stand or fall, when measured by this standard, they should be accepted or rejected.

The charm of novelty which was in great measure responsible, some years ago, for the adoption of electricity for lighting and power purposes, has now to a very large extent worn off. Ten years ago, electric lighting was undoubtedly considerably more expensive than gas and other forms of illuminant; on the other hand, it was reasonably safe, clean, convenient, and, above all, new. Nowadays, when its safety has been enormously increased, and when its adaptability and cleanliness have been abundantly proved beyond dispute, these factors alone are not considered sufficient to justify its selection. The point of view has changed, and a strongly utilitarian instinct is brought to bear on the question, so that cheapness is now the deciding element in the case. This aspect is being borne in upon the minds of managers of power stations, and every means of reducing the cost of supply is being sought. The labour item of the expenditure is attacked by the supersession of manual labour by mechanical means of performing the work, with, in many cases, very indifferent results.

That the wise introduction of labour-saving machinery must result in economy cannot be disputed, but it is only too evident that its reckless adoption can only mean increasing the capital indebtedness of the business, without showing any corresponding diminution in the revenue charges. It is obvious that there can be no gain in simply transferring the labour charges from the revenue to the capital account, and yet this is what is frequently the result of the installation of many types of labour-saving plant, under unsuitable conditions.

The adoption of mechanical agencies for elevating coal and ashes, for conveying these commodities, for the firing and cleaning of boilers, and for the motive power of travelling cranes, provides the most familiar instances of the passing of manual labour, occurring in power stations. It is undeniable that these and similar operations are very much more efficiently and economically performed y machinery than by hand, provided that sufficient work can be found to keep the gear in fairly constant employment.

In the case of most of our modern central stations, however, this condition is by no means met, and the public generating works with a load factor good enough to permit of such continual work, is representative of a very small minority.

It is not an unfair statement of the case to say that in most power houses the plant at work during 18 of the 24 hours is a comparatively small proportion of that employed at full load, and a considerably smaller proportion of the total plant installed. It is, nevertheless, usual, where mechanical labour is adopted, to see it applied up to the whole capacity of the plant.

The fitting of mechanical stokers is such usual and almost universal practice, that it is very probable that the economy to be effected is often not considered at all, or else is taken for granted, and it may be worth while to investigate this question to see to what extent the procedure is justifiable.

It is not proposed to discuss the case of the small lighting station with three or four boilers, and a very poor load factor, where mechanical stokers are too obviously out of place to make the instance worth considering.

Selecting an average moderate-sized power house of some 5,000 H.P. installed capacity, we find that the peak load in the depth of winter is perhaps two-thirds of this amount or, say, 3,500 H.P. This figure represents the mean of the stations of about this capacity in the United Kingdom. Such a works will have, perhaps, eight or nine boilers, and in most cases will be provided throughout with mechanical stoking gear. Analysing the working of these boilers, we find that for some six months of the year the whole load is taken by three or at the most four; for perhaps four months, two more are required, and for the remaining two months seven or eight boilers will be at work on the heavy load days. One boiler may be always considered as down for cleaning purposes. It may, then, be said that two boilers are actually at work about 100 hours in the year, and that two more will average about 250 hours per annum.

One boiler, of course, may be assumed to do no work at all, or only an hour or two a week in winter, being laid aside for cleaning, but as this is necessary and inevitable, we

do not propose to include it in the inquiry. We have, therefore, four boilers with a mean working year of 180 hours. The cost of fitting mechanical stokers to these boilers will be perhaps £70 to £80 each more than that of supplying ordinary hand-firing furnaces, or, say, £300 on the four. Taking interest on this amount at 3½ per cent. and giving the apparatus a 15 years' life, we find something like £30 per annum chargeable against the installation.

To hand-fire four boilers, two or at most three men would be required, while with machine firing two men are certainly necessary if the coal has to be lifted to the hoppers by hand. Supposing, then, that one man's wages are saved for 180 hours per annum, we economise to the extent of, perhaps £4 10s., and the apparatus to effect this costs £30 for the same period.

It may be argued that with such a short working period the life of the gear would be more than 15 years, but it is fairly safe to say that after a lapse of this time it would be certain to have been replaced even if not actually worn out, and that it must consequently be paid for within such time.

It is also admitted that mechanical firing is considerably more efficient, if properly done, than hand firing can possibly be, but here again the working hours are too short to allow of this difference amounting to anything considerable.

On all counts, the discrepancy between the cost of the apparatus and the saving resulting from it is sufficiently great to show that for the conditions obtaining in a present-day electrical power station it is a very false economy to fit mechanical stokers to all the boilers.

Investigating on similar lines the performance of coal and ash elevating and conveying gear, it is at least doubtful if the results obtained from its installation will equal those derived from the mechanical stokers, although very much depends on the storage available, and the capacity of the machinery.

A modern coal-handling plant, as fitted in a central station, is usually capable of delivering enough fuel to cope with the maximum requirements of the boilers, apart from the matter of storage. The natural result is that the plant is either idle or only very occasionally employed during the long period of light load, so that the capital charges are out of all proportion high when compared with the running costs.

Again, owing to the severity of the conditions under which such plant is operated, the upkeep and repairs account is relatively very heavy, and the life very short. In three or four installations which have come under the writer's notice, the constant attention of as many men has been required to keep the gear clean and in good running order, as would have sufficed to do the work manually.

The very attractive figures of a penny or so per ton as the cost of handling the coal and ashes, so often quoted by makers of apparatus for the purpose, are apt to be rather misleading. It may be pointed out, without in the least disputing the truth of such statements that they represent the performance achieved by the constant work of the machinery at its full capacity, and are consequently hardly relevant to the conditions of average central station work.

The cost of manually lifting coal from the firing floor to the grate of the boilers is from 3d. to 4d. per ton, and it is to be feared that comparatively few coal-handling plants in lighting and power stations can actually improve on this figure when everything is considered. To make the comparison equitably, the life of the apparatus may be placed, as a generous allowance at 10 years, a period which, with most classes of machine, is certainly an outside estimate.

Other applications of power in station plant show on similar reasoning as little justification of their adoption, a notable instance being the power-driven overhead traveller. This is a machine which will get very little actual work, and is a case where the provision of motors with the necessary switch and other gear is surely rather an expensive luxury.

From the few examples considered in this article in a more or less superficial way, it would appear to be necessary to emphasise how essential it is that the capital account should receive equal attention with the revenue account.

In the effort to reduce the actual working costs of the station, many engineers seem to lose the correct perspective of things, and adopt measures to attain this end which far outweigh in expense any saving they may make. The whole question is one of load factor, and this can only be improved by giving power at such a cheap rate as to attract custom. To this end the capital costs must be at the lowest possible point consistent with safety, a condition not to be by any means obtained by the installation of cheap and second grade plant, but by judicious inquiry, so as to be sure before making additions and extensions to plant, that these are required, and are reasonably certain to repay the outlay upon them.

It is only by the application of the strictest principles of economy to both capital and revenue sides of the expenditure that the field of the electrical industry can be rapidly widened to the extent it is destined to reach. In a recent article in *Engineering*, by Mr. Addenbrooke, the total capital cost of a station of 3,500 KW. installed was given at £22 per kilowatt. Comparing this figure with the actual expenditure of the municipal generating stations of these dimensions, we find a considerable difference, the latter averaging £72 per kilowatt installed. This large discrepancy is, of course, to be accounted for in great measure, by the phenomenally rapid development of electrical plant, but it serves to show strongly the amount of leeway which must be made up in the future.

## OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"M. M." writes:—"A year or so ago we fitted up a private telephone line. The wayleaves were secured all right, but we have just had notice from one landlord of property over which the wire is suspended to remove within 14 days, although no fixing has been made to his property, and nothing is touching or interfering in any way. Must we remove it?"

*** "M. M." does not state whether the landlord in question was one of those who granted a wayleave. It appears, however, from the burden of his complaint that this is not so. It is quite clear that no man has any right to suspend wires over another man's land, even where the wires do not touch anything, without leave or licence. "M. M." must, therefore, remove the line in question. Assuming, however, that the landlord is one of those who granted a wayleave, no doubt the wayleave can be put an end to by notice. This will depend upon the terms of the agreement.

## ELECTRICAL MATTERS AT THE LONDON CHAMBER OF COMMERCE.

The annual report of the London Chamber of Commerce, which was adopted at the annual meeting held on Thursday of last week, under the chairmanship of Mr. T. F. Blackwell, stated that the Electrical Trade Section and its committees had held several meetings during the year. At the annual meeting Mr. C. P. Sparks was re-elected chairman, and Messrs. C. H. W. Biggs and W. L. Madgen were re-elected deputy chairmen.

The Section took action in connection with several Bills before Parliament. Resolutions were passed objecting to the Government Valuation Bill, and a small committee was appointed to co-operate with other Sections of the Chamber in giving effect to the views of the Sections. The Section generally approved the provisions of the Supply of Electricity Bill—subject to slight modifications on points of detail—as being a necessary measure, which would have the effect of removing the difficulties which had arisen in the past in the development of the electrical supply industry.

A discussion also took place with regard to certain draft regulations arising out of the report of the Departmental Committee on Electricity in Mines, which, it was suggested, would affect the electrical industry generally, as well as the mining industry in particular, and might also become the basis of future regulations affecting the whole electrical industry. The Home Office wrote stating that the Secretary of State would consider any observations on the suggested rules which might be sent in. The Section submitted that rigid regulations should not be applied at the moment, and that as the proposed regulations would apply to all surface work in collieries as well as to the underground systems, it was desirable that regulations applying to surface works should not be put into force until such time as general regulations were issued for use in all electrical undertakings, and should not in any case be more restrictive than those issued by the Board of Trade. It was also pointed out that the progress of the electrical industry as applied to mining would be curtailed by the issue of the proposed regulations (containing 115 rules), and therefore, without dealing

with the whole of the suggested rules, the Section particularly drew attention to technical objections to some of them. The regulations as finally issued were found to have been greatly modified, the majority of the points to which the Section drew attention having been met by the Home Office. A request was received from the Board of Trade for observations on certain draft regulations for securing the safety of the public, and for ensuring a proper and sufficient supply of electrical energy, issued under the Electric Lighting Acts, 1882-1888. The Section sent in certain suggested amendments pointing out the desirability of incorporating extra high-pressure regulations in the amended regulations, and the necessity of increasing the limit of pressure regulations applicable to power consumers above the 4 per cent. allowed. The Section considered draft regulations relating to the use of electricity in factories, a large number of communications being received from members on the subject. It was decided that objections should be sent in to the Home Office with the object of securing a *locus standi* at the inquiry which would be held in due course in accordance with the provisions of the Factory and Workshop Act, 1901. The Section pointed out generally the difficulties and inconveniences which might arise from the existence of two sets of regulations administered in the same factory by two different Government Departments, and submitted that the Home Office regulations should be on identical lines with the proposed amended Board of Trade regulations under the Electric Lighting Acts, 1882 and 1888; also that the testing departments of electrical manufactories should be exempted from the operation of the regulations, as electrical manufacturers were manifestly unable to comply with the regulations in view of the special circumstances of the case. In regard to particular clauses, the Section made suggestions in connection with the exemption of main distributing boards, that an approved form of lampholder be allowed under Clause 5, and that the onus of giving annual certificates should not be imposed on "undertakers." A number of other subjects were dealt with by the Section during the year.

## NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

5,789. "Improvements in electric motor controllers." The Electric and Ordnance Accessories Co., Ltd., R. F. Hall and J. Richardson Garner. March 20th. (Complete.)

5,814. "An improved automatic accumulator charging switch." H. Hirst and E. E. Stewart. March 20th.

5,820. "Improvements in brush-holders for dynamo-electric generators and electro-motors and other electric apparatus." Electro-motors, Ltd., and J. H. Hamilton. March 20th.

5,821. "Improvements in mercury vapour lamps (electro-thermo-mercury vapour lamp)." J. Sewirsky. March 20th.

5,827. "Improvements in field systems for continuous-current motor-electric meters and needle instruments." C. W. J. Busch. (Date applied for under Patents Act, 1901, March 2nd, 1904, being date of application in Germany.) March 20th. (Complete.)

5,829. "An improved contact-maker for electrical ignition devices and like uses." G. W. Brindley and S. J. Bale (trading as The Barnstaple Motor Co.) and S. J. Murphy. March 20th.

5,834. "Improvements in the windings of electrical machines." Siemens Bros. & Co., Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) March 20th. (Complete.)

5,836. "Improvements in or connected with electric glow lamps." L. Scholvien. (Date applied for under Patents Act, 1901, September 29th, 1904, being date of application in Germany.) March 20th. (Complete.)

5,863. "Improvements in electric train signals." A. W. Sullivan and W. Renshaw. March 20th. (Complete.)

5,865. "Improvements in the construction of conduits for containing electric cables and wires and other wires, tubes, pipes and the like." W. Hepworth-Collins. March 20th.

5,866. "Electrically operated tubes or bulbs containing rarefied gas or vapour." F. W. Howorth. (The Moore Electrical Co., United States.) March 20th. (Complete.)

5,882. "Manufacture of lithopones by electrolysis of sulphates or chlorides of soda and consecutive production of caustic soda." J. B. Candau and A. Candau. March 20th.

5,887. "Improvements in the electrolytic manufacture of copper wire, strip or the like." S. O. Cowper-Coles. March 20th.

5,893. "Improvements in electrically propelled vehicles and permanent way therefor." A. St. V. Burnaby. March 20th.

5,896. "A magnetic automatic motor." T. Grainger. March 21st.

5,899. "Improvements in electric motors." Mather & Platt, Ltd., E. Hopkinson and J. Firth. March 21st.

5,918. "Improvements in electric batteries and in electrolytic processes and apparatus." Chamberlain & Hookham, Ltd., and S. H. Holden. March 21st.

5,944. "Improvements in means for controlling electric circuits." H. Leitner and R. N. Lucas. March 21st.

5,976. "Improved means for regulating compensated series electric motors and generators." The Elektrizitats Act-Ges. vormals W. Lahmeyer & Co. (Date applied for under Patents Act, 1901, April 5th, 1904, being date of application in Germany.) March 21st. (Complete.)

5,977. "Improvements in connection with polyphase alternate current electric machines provided with commutators." The Elektrizitats Act.-Ges. vormals W. Lahmeyer & Co. (Date applied for under Patents Act, 1901, April 15th, 1904, being date of application in Germany.) March 21st. (Complete.)

5,978. "Improvements in and relating to methods of and apparatus for synchronising dynamo-electric machines." The British Thomson-Houston Co., Ltd., Hans S. Meyer and P. A. Mossay. March 21st.

5,979. "Improvements in articles made of granular material such as brushes for dynamo-electric machines and in methods of manufacturing the same." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 21st.

5,980. "Improvements in and relating to alternating current dynamo-electric machines." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 21st.

5,981. "Improvements in and relating to alternating current motors." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 21st.

5,982. "Improvements in means for protection against short circuits." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 21st.

5,983. "Improvements in and relating to dynamo-electric machines." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 21st. (Complete.)

5,984. "Improvements in electrodes adapted for use in electric furnaces." E. F. Price, G. E. Cox and J. G. Marshall. March 21st. (Complete.)

6,052. "An air suction contact device for stopping printing machines and the like by electricity." E. Wetzel. March 22nd.

6,053. "Improvements connected with electric lamps for illuminating time pieces and for other uses." J. C. Vickery. March 22nd.

6,066. "Improvements in or relating to electric clocks." F. Hope-Jones. March 22nd. (Complete.)

6,067. "Improvements relating to dynamo-electric machines." The Phœnix Dynamo Manufacturing Co., Ltd., R. Pohl and F. Pohl. March 22nd.

6,072. "An electric lamp adaptor for oil, gas or other illuminant for motor, cycle and other lamps." G. Davenport. March 22nd.

6,073. "Improvements in electrical mercury switches operated by a vehicle passing along a railway." Siemens Bros. & Co., Ltd. (Siemens & Halske Aktien-Gesellschaft, Germany.) March 22nd. (Complete.)

6,077. "Improvements in and relating to apparatus for indicating when the trolley-standards of electrically-driven vehicles become 'alive,' and for guarding the standards when in such a condition." P. J. Pringle. March 22nd.

6,089. "Improvements in magneto-electric generators." T. W. S. Hutchins. March 23rd.

6,091. "Improved means for laying telegraph and like poles." J. R. Brown. March 23rd.

6,116. "Improvements in electric light counterweight fittings." J. McFarlane and H. Watson. March 23rd.

6,176. "Improvements in and relating to relays for telephones, telegraphones and the like." J. H. Christensen. March 23rd. (Complete.)

6,192. "Improvements in oscillographs." The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 23rd.

6,238. "Insulating and acid resisting sets, comprising of all metallic goods used for secondary batteries be vitreous enamelled." A. Thomas. March 24th.

6,245. "Accumulator, constructed of the pillar type of electrodes." A. Thomas. March 24th.

6,257. "An automatic reverse current safety throw-over switch for compound-wound traction generators." G. B. Parlett and G. H. Coxon. March 24th.

6,259. "Improvements in apparatus for regulating the pressure in direct-current electric mains." W. Buchanan. March 24th.

6,267. "Improvements in imitation candles for electric light." B. M. Drake. March 24th.

6,269. "Improvements in systems of electric lighting." H. Leitner and R. N. Lucas. March 24th.

6,271. "Improvements in pressel switches for electric lighting." G. J. Bonnella and A. Bonnella. March 24th.

6,272. "Improvements in and relating to vapour electric lamps and the like." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) March 24th.

6,280. "Improvements in and relating to telegraphic transmitters." J. T. Szek. March 24th.

6,286. "Improvements in attaching insulators to tubular or like arms or brackets." Siemens Bros. & Co. Ltd., and G. W. Perry. March 24th. (Complete.)

6,307. "A new or improved unipolar cell and method and means of converting and or transforming continuous currents of electricity." R. Grisson. March 24th. (Complete.)

6,376. "Improvements in means for regulating variable-speed dynamos." H. Leitner and R. N. Lucas March 25th.

6,383. "Improvements in electric switches having resistances." E. Garside. March 25th.

## PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

### 1904.

Electric Alternating Current Machines. M. Latour. 2,471. February 1st. (Date claimed for patent under Patents Act, 1901, February 2nd, 1903, being date of application in France.)

Electric, Gas, or Vapour Lamps. M. Von Recklinghausen. 2,495. February 1st.

Apparatus for Producing Oscillatory Currents. P. C. Hewitt. 2,496. February 1st. (Date applied for under Patents Act, 1901, February 9th, 1903, being date of application in United States.)

Electrical Joint Boxes. W. E. Groves. 2,512. February 2nd.

Means for Rectifying Alternating Currents. E. Weintraub. 2,580. February 2nd. (Date claimed for patent under Patents Act, 1901, February 2nd, 1903, being date of application in United States.)

Machines for Making Stems for Incandescent Lamps. The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) 2,581. February 2nd.

Terminals for Electric Batteries. H. G. Prested. 2,614. February 2nd.

Electric Couplings for Arc Lamps and the Like. O. Schaeffer. (H. Bastians & O. Wehrman, Germany.) 2,676. February 3rd.

Electric Arc Lamps. The British Thomson-Houston Co., Ltd., & E. J. Murphy. 2,715. February 3rd.

Electric Telegraphy. B. Gati. 2,734. February 3rd.

Electro-Motors of the Induction Type. F. M. Lewis. 2,930. February 5th.

Wattmeters. W. du Bois Duddell. 2,948. February 6th.

Controllers for Electric Motors and Other Apparatus. G. Laird & J. P. Todd. 3,000. February 6th.

Apparatus for Amalgamating and Coating Metals or Alloys of Metals with Metals or Alloys of Metals by the Aid of Electricity. H. M. W. P. Johnson. 3,037. February 8th.

Suspension Chains for Electroliers, Chandeliers, and the Like. F. T. Nash. 3,169. February 9th.

Electrical Measuring Instruments and Apparatus for Use Therewith. W. C. Fisher. 3,205. February 9th.

Fuse Box for Electric Cables. W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. 3,216. February 9th.

Tremblers for Electric Circuits. W. G. Wilson and Wilson & Pilcher, Ltd. 3,236. February 9th.

Electric Telegraph Apparatus. S. G. Brown & A. R. Hardie. 3,221. February 9th.

Induction Transformer for Wireless Telegraphy Receiving Stations. E. Ducretet. 3,244. February 9th.

Switches for Electric Lighting. A. P. Lundberg & G. C. Lundberg. 3,328. February 10th.

Telephones. J. E. Kingsbury. (The Western Electric Co., United States.) 3,431. February 11th.